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Contents

NOTICES:—All communications relating to editorial matter should be addressed to the Editor, who will be pleased to consider articles or contributions dealing with modern chemical developments or suggestions bearing upon the advancement of the chemical industry in this country. Communications relating to advertisements or general matters should be addressed to the Manager.

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Mechanical Handling Plant

WITH the development of the system of centralised control, the steady enlargement of the scale on which works operations are conducted, the consequent increase in the bulk of material handled, and the enormously advanced cost of labour, coupled with the undiminished touchiness of the manual worker, the problem of the mechanical handling of materials has come to be recognised as one of first-rate importance. Even now, however, the science is far from being as well understood in this country as it might be, and some acknowledgment is due from our commercial organisations to the group of technical engineers who have made an intensive study of it. Some of the results of such studies and experiences are disclosed in the contributions to our present issue, and they indicate the progress which is being gradually made in the elimination of defects and in the perfection of the mechanism of handling and conveying processes. Mr. Herbert Blyth, for example, discusses "The importance of Low Handling Costs"; Mr. Alwyne Meade, the author of "Modern Gasworks Practice," offers "Some Practical Considerations with Handling Plant;" Mr. G. F. Zimmer discusses various applications of conveying machinery in chemical works; Mr. E. W. L. Nicol describes installations for the automatic handling of coal and ash; and further contributions deal with ball-bearing equipped handling appliances, economical crushing and grinding machinery, &c. Fortunately, the old objection to the substitution of machinery for manual labour has largely disappeared, and the workers themselves are realising that the proper function of the human factor is the control rather than the personal provision of power.

Turning to the practical side, it may be added that since the termination of the war the works manager has been faced with a succession of adverse conditions which have compelled him either to abandon all thought of putting in hand extensions which he knows full well will add to the efficiency of his operations, or to reduce his outlay on such extensions to the lowest possible figure. During the first two years which followed the Armistice there were few who could conscientiously recommend the installation of plant which was standing at least 150 per cent. above its pre-war level; while, when materials began to fall in price and wages started to be cut, the universal stagnation of trade proved an even more serious obstacle. At the moment it is particularly pleasing to note that the trade barometer shows a decided upward tendency, and from the point of view of mechanical handling devices the outlook is very much more favourable than it has been for some time. This is indicated by the fact that applications for tenders are increasing in number, which shows that prospective purchasers are becoming aware that the present is by no means an unfavourable time for getting ahead with extensions—particularly if the buyer is protected in his contract by a clause giving him the advantage of any drop in the values of materials and labour prior to the completion of the work. The larger contracting undertakings are still inclined to complain of the fact that to-day a great deal of time is expended in supplying tenders from which no business results. This, however, is inevitable in the transitional stage from a period of exceptional depression to one of greater activity, and after what has been experienced it should be particularly gratifying to know that there are a fair number of applications for tenders about. We were struck with a remark, made only the other day by the representative of a north country firm of engineers, that whereas prior to the war he found himself in competition with only some half-dozen tenders, it is quite common nowadays to find as many as forty firms quoting for the same job.

Rewards for Inventors

THE troublesome problem of allocating rewards for inventions to persons in the service of the Government is reviewed shortly but thoroughly in the report of the representative committee which, under the chairmanship of Dr. Kenneth Lee, has been inquiring into it (H.M. Stationery Office, pp. 25, 7d. post free). Shortly the Committee's recommendations are the following :—

1. That an Inter-Departmental Patents Board, not representative of Government Departments, but consisting of independent persons of suitable knowledge and experience, should be established to deal with matters arising in connexion with inventions made with the aid of public funds ; but that certain matters described in Sections 16 and 17 of the Report should be excluded from its scope.
2. That this Board should itself deal with awards to inventors, but that it should delegate its powers of commercial exploitation to a separate committee consisting of members nominated by Government Departments (including the Treasury) and members selected from a panel of business men.
3. That committees established by separate Departments should deal with minor awards.
4. That the cost of the Inter-Departmental Patents Board should be borne on the Vote of His Majesty's Treasury, but that no award which it might make should be subject to revision on the sole ground of its amount.
5. That, so far as inventions made by Government servants are concerned, the functions of the present Royal Commission on Awards to Inventors should, when that body has completed its functions, be taken over by the Inter-Departmental Patents Board.

The steps by which the Committee have arrived at these conclusions are clearly described ; and the document in this respect is an admirable piece of condensed history. The present regulations provide that no departmental officer or other person employed may take out a patent without the permission of his responsible superior officer, and that the patentee, if so ordered, shall assign the rights to the head of his department. In practice this regulation takes three forms. If the Department desire to retain complete control, assignment of the patent is ordered and the inventor is not allowed to dispose of his commercial rights. When a Government Department is satisfied with an agreement securing the right to use the invention or patent, the inventor is otherwise free to dispose of his invention for commercial purposes. When the Department has no interest in the invention or patent the patentee is free to deal with his invention as he thinks fit. In the comparatively simple conditions before the war these regulations caused little or no inconvenience, but the enormous extension of the boundaries of national service during the war, and the establishment of the Department of Scientific and Industrial Research, resulting in the production of inventions of commercial value by its own servants or by persons in receipt of special research grants, have made a complete survey and revision of the old conditions imperative.

Generally the Committee agree with the view that the employed research worker should not be entitled to a reward or to any rights in any invention made in the course of his duty ; at the same time they appreciate the feeling among scientific men that rewards for specially meritorious work would have the effect of encouraging further effort. In each case, they suggest, the circumstances should be considered on the general principle that the invention belongs to the State, and the reward allocated accordingly. The committee, again, sympathise with the view that rewards should not be confined to inventions or discoveries of immediate commercial applicability, since, as they remark, " the whole history of discovery and invention shows clearly that a very large proportion of the advances made in industrial practice are due to research work of a fundamental nature whose application to industry could not be foreseen," but they refrain from definite proposals. Where a research worker claims that his invention is outside the course of his employment the onus of proof is placed upon the claimant. The establishment is suggested of an Exploitation Committee, composed of a considerable proportion of business men, to deal with the commercial exploitation of Government patents, and finally it is recommended that secret inventions should continue to be dealt with departmentally.

Gasworks Theory and Practice

WHAT promises to be one of the most important enterprises in technical publishing of recent years is announced by Benn Brothers, Ltd., publishers of THE CHEMICAL AGE. This is a series of monographs, running in length from 250 to 500 demy octavo pages and fully illustrated, covering the whole ground of gasworks theory and practice. Each subject will be handled by one of our leading English authorities. Mr. P. Parrish, chemical engineer to the South Metropolitan Gas Co., will contribute a volume on " By-Product Ammonia " ; Dr. Leonard Levy will be responsible for " Gasworks Recorders " ; Dr. Geoffrey Weyman will provide in " Modern Gasworks Chemistry " the first standard work on the subject, which should form a companion volume of the greatest value to Mr. Alwyne Meade's " Modern Gasworks Practice " ; " Coke and its Industrial Uses " has been entrusted to Mr. E. W. L. Nicol ; Mr. Rambush will treat of " Producer Gas " ; while Mr. Ferguson's volume on " Coal Tar Intermediates " will, when taken in conjunction with Mr. Warnes' well-known " Coal Tar Distillation," form a complete guide to the practice of this subject. Finally, from the pen of Dr. Lander will come a book on " Low Temperature Carbonisation," which, it is not too much to say, should prove of historic importance. The publishers hope to issue the first few volumes in the autumn of this year, and others at short intervals. Meanwhile good progress is being made with the same firm's recently announced series of handbooks on chemical engineering, which it is clear from the numerous inquiries received is attracting widespread interest. The first five volumes are now in the press, and very shortly, it is hoped, chemical engineers will have available the earlier numbers of a group of practical little works, the need of which has of late been increasingly felt and emphasised.

The general spring catalogue for 1922, just issued, illustrates the important extensions in Benn Brothers' publication department which have recently taken place under the direction of Mr. Victor Gollancz. Already well known for standard technological textbooks for several industries, the field has now been extended to include history and geography, politics and economics, art and architecture, &c. In short, the humanities promise presently to be almost as strongly represented as science and technology already are.

Chemicals at the B.I.F.

THE exhibition of chemical products at the British Industries Fair, which opens in London on Monday and continues until March 10, promises for the first time in the history of these fairs to be creditably representative of British chemical industry. In these matters there are only two courses to choose between —either to do the thing really well or to let it altogether alone—for a feeble and unrepresentative collection merely damages our reputation. This year about sixty of the leading British chemical organisations are represented, and their exhibits are grouped together with a view to producing a good collective effect. While these are by no means exhaustive, they are sufficient to indicate the range and strength of the chemical industries of this country. They record something of the advances made during and since the war, and they justify hopes for the future.

Some controversy has taken place as to whether the merchant class should be admitted as exhibitors, but the special committee appointed to inquire into the matter has decided against the proposal. This, in practice, excludes from the exhibition the smaller type of British chemical manufacturer who has not the resources to organise his own selling and distributing agencies, and who has to rely in this matter on the services of the merchant-trader. The committee were not indifferent to this objection, nor to the importance of the merchant's functions, but on a balance of advantages and disadvantages they decided in favour of limiting the exhibitors to British manufacturing firms. The principle, therefore, on which the chemical exhibits have been organised hitherto will be continued in the future.

German Dyestuffs

SIR WILLIAM ALEXANDER'S comprehensive review of the position and prospects of the dyestuffs industry throughout the world, published in THE CHEMICAL AGE of January 7, has not unnaturally attracted attention in Germany. In a recent issue of the *Industrie und Handels-Zeitung*, a journal in which we believe Herr Stinnes has a personal interest, the statement that Germany's production of dyestuffs is greater now than before the war is directly challenged. According to trustworthy information of which this journal claims to be in possession, the German production, which before the war amounted to 135,000 tons a year, is stated to be considerably below that figure. Coal-tar dyes production, which in 1913 amounted to 130,000 tons a year, is stated to have decreased in 1920 to hardly half that amount, and for the past year the output is fixed at little more than 80,000 tons. The figures given in Sir William Alexander's article of the production in the other four chief producing countries were:—U.S.A., 32,000 tons; England, 30,000 tons; Switzerland, 12,000 tons; and France, 8,000 tons. If the figures given in the *Industrie und Handels-Zeitung* are correct, the reduced production of Germany is still almost exactly equal to that of the four other nations referred to. This subject is also dealt with in similar terms in the *Kölnische Zeitung*.

Points from Our News Pages

This issue being specially devoted to the problem of mechanical handling in chemical works, articles on the subject are published from Mr. Herbert Blyth, Mr. Alwyne Meade, Mr. G. F. Zimmer, Mr. E. W. L. Nicol, and others (pp. 226-240).

The Cream of Tartar inquiry was resumed on Thursday, February 16, continued on Friday and Saturday, and adjourned to to-day (February 25). A new inquiry under Part II. of the Safeguarding Act, in relation to bronze and aluminium powders, was opened on Tuesday (p. 242).

A list is published of the chemical exhibitors at the British Industries Fair to be opened in London on Monday, together with a ground plan of the stalls (p. 241).

Our London Chemical Market report states that a feeling of greater confidence is steadily developing, and that, while business is still largely confined to prompt requirements, the turnover is improving (p. 251).

The past week, according to our Scottish Chemical Market report, has justified expectations of steady, if slow, improvement in the general chemical trade (p. 253).

The Calendar

Feb. 27	Royal Society of Arts: "The Mechanical Design of Scientific Instruments." Professor A. F. C. Pollard. 8 p.m.	John Street, London.
27 to Mar. 10	British Industries Fair	London and Birmingham.
Feb 28	Society of Chemical Industry, Edinburgh and East of Scotland Section: Joint dinner with the Local Section of the Institute of Chemistry. 7. p.m.	129, Princes' Street Edinburgh.
Mar. 1	Society of Public Analysts: Ordinary Meeting. 8 p.m.	Burlington House, London.
2	Society of Dyers and Colourists, Leeds Junior Branch: "Faults in Dyeing." D. T. McLellan.	Leeds.
2	Society of Dyers and Colourists, W. Riding Section: Lecture by J. W. McBain.	Bradford.
2	Chemical Society. Ordinary Scientific Meeting.	Burlington House, London.
2	Royal Society: Papers by various authors. Communicated by Professors W. M. Hicks, A. Fowler, Sir W. Pope, and others.	London.
3	Society of Chemical Industry, Manchester Section: "A contribution to the study of the oxidation of coal." F. S. Sinatt. "On a cause of splitting of a pottery material." Mrs. M. B. Craven. 7 p.m.	Textile Institute, Manchester.
3	The Sir John Cass Technical Institute: "Recent developments in the glass industry." Lecture II. W. E. S. Turner and S. English. 7.30 p.m.	Jewry Street, London, E.C. 3.
4	London County Council Lectures: "Vitamins." Professor A. Harden. 10.30 a.m.	The Polytechni Regent Street, London.
4	West Yorkshire Metallurgical Society: "Surface and Internal Defects inIron Castings, their Relationship, Cause and Prevention." J. E. Fletcher. 6.45 p.m.	Technical College Bradford.
4	Royal Institution: "Radioactivity. Lecture I. Sir E. Rutherford.	Albemarle Street, London.

The Importance of Low Handling Costs

By Herbert Blyth, M.Inst.C.E.

THE importance of the chemical industry to this country can hardly be exaggerated. At the present time it is second only to that of coal, and it is quite possible that within a conceivable period the premier position now occupied by the coal industry may be taken by the chemists and chemical manufacturers. In a fully developed "chemical age" the chemist will probably be able to give us such a perfect method of recovering heat energy, and means of using it so efficiently, that the quantity of coal required by the community will be very greatly reduced. Thus an enormous amount of wear and tear will be saved, labour used to better advantage, and human energy conserved. Further, it is to the chemist we must look for an adequate supply of nitrates, improvement in the production of steel, and the production of food in sufficient quantities to satisfy the whole population, and at such a price that every man can obtain what he needs by a fair exchange of his daily services.

If the chemical industry is going to perform all the great things that are expected of it for the benefit of mankind, it will have to be invigorated by the sweeping away of inefficiencies and the employment of modern methods. Many works are in almost a dilapidated condition; others suffer from cramped surroundings, bad transport arrangements, or old-fashioned plant. Some chemical companies have had the misfortune to be wrongly advised and have been persuaded to adopt new plant, which has proved a source of loss instead of the expected profit.

In nearly all chemical works, however, the want of efficient unloading and conveying plant is one of the chief causes of the high cost of production. It is an established fact—in all industries which depend upon the conversion of a large bulk of raw material into any kind of product—that the cost of that product is almost directly proportional to the cost of simply moving the material about the works, through the plant, and out of the works again. Another factor in the cost of production is the speed of handling the material. If the whole plant is kept up to its full capacity by proper feeding in of the materials at all points, the cost of the products will naturally be much less than in the case of a similar plant where there is a restricted delivery of the materials to the plant.

The problem of mechanical handling has been successfully solved in several chemical works, but in others the means adopted for unloading and conveying the various materials are of a very primitive nature, and obviously far too slow and inefficient to enable the plant to produce up to the full capacity of which it is capable with suitable handling appliances. There are, however, many obstacles to the introduction of new methods into an old works, and before anything really useful and profitable can be done in a given case, the daily routine of the works and the general conditions must be very carefully examined.

Anyone with a knowledge of conveying machinery, upon visiting a more or less antiquated chemical works, is immediately struck with the enormous possibilities of effecting improvements; but after a little reflection he is soon up against structural difficulties—the severely corrosive action of the local atmosphere, or the materials to be carried, and financial obstacles. Again the problem in some works is undoubtedly complicated by the relatively small quantities of the several different kinds of materials which have to be dealt with (although the aggregate quantity may be very considerable); materials of different nature often require totally different handling.

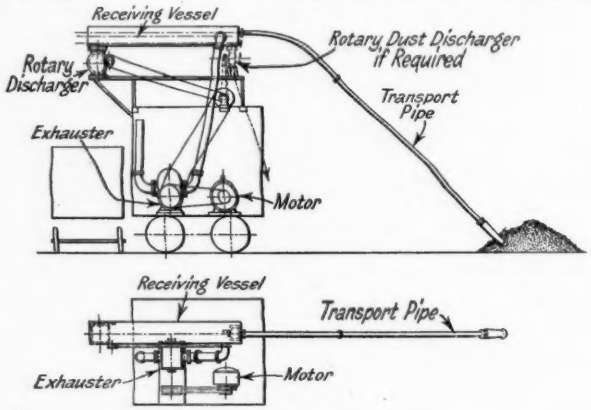


FIG. 1.—COMPLETE PNEUMATIC PLANT FOR LOADING OR UNLOADING, MOUNTED UPON PORTABLE TRACK.

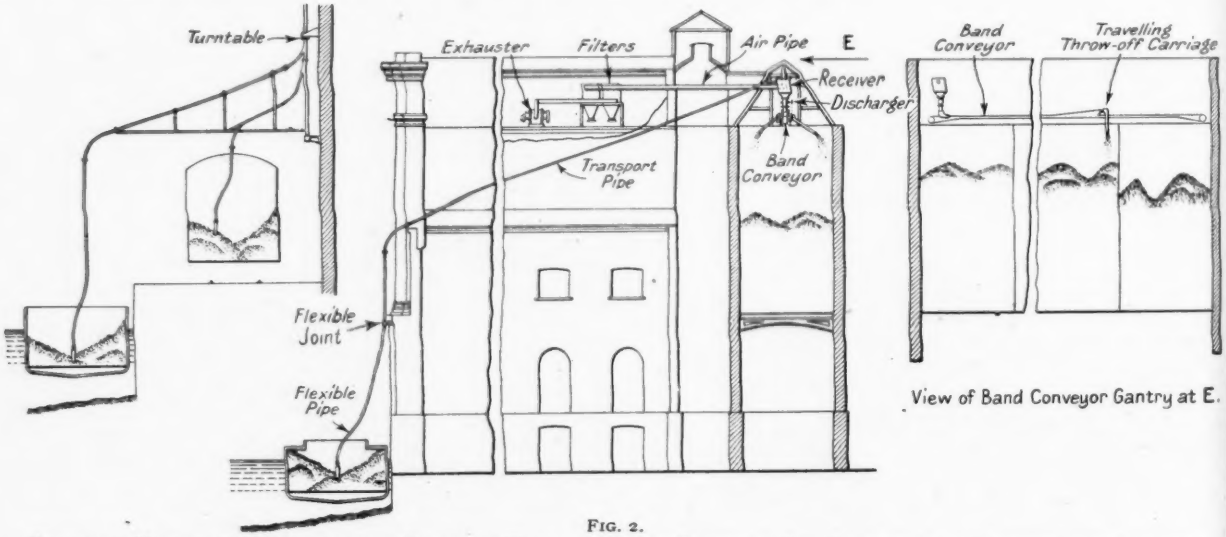


FIG. 2.

PNEUMATIC METHOD OF UNLOADING FROM BARGES OR WAGONS, SHOWING TRANSPORT PIPE DELIVERING TO RECEIVER, WHICH IN TURN DELIVERS TO HORIZONTAL BAND CONVEYER.

For example, in one particular case that came under the writer's notice the different materials to be considered in the one works were (1) pyrites (containing iron and copper) in 1½ in. or 2 in. cubes; (2) flowers of sulphur; (3) large coal; (4) limestone, &c., to be unloaded at a railway siding and conveyed by different routes into the works and into storage.

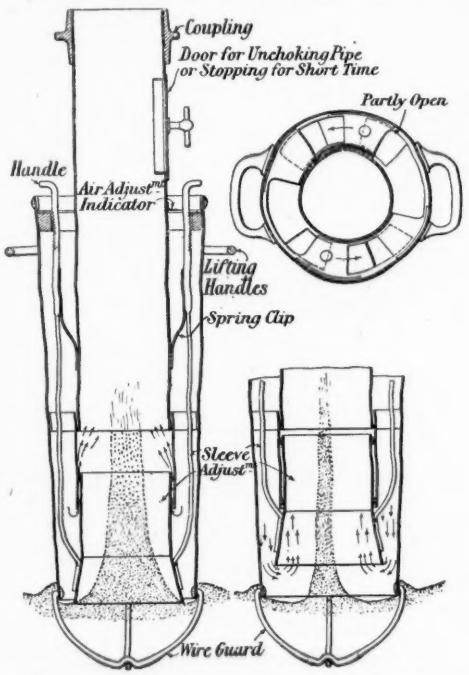


FIG. 3.—NOZZLE AT END OF TRANSPORT PIPE.

There were also the questions of conveying from the storage heaps and bins to mills and furnaces, the conveying of fine ore to copper extraction vats, and, lastly, the removal of iron ore sludge from the vats to railway trucks.

In an investigation of such a case, it is only possible to proceed towards a useful conclusion by, first of all, taking each requirement separately, then tabulating the quantities and suitable means of handling each kind of material, and finally co-ordinating the practical possibilities to determine the best means of handling which is common to the greatest number of the various requirements. A systematic study of the whole problem in this way will often reveal the correct solution.

It will no doubt be of interest to mention some of the methods of handling which are applicable to certain conditions: There are now mechanical means available for handling any class of material, but for the reasons given the selection of the right means for a given case is not easy, and it often requires the combined brains of the chemist, the engineer, and the financial man to decide upon the most suitable plant, and to estimate the sum total of advantages which may reasonably be expected to accrue.

Take the three main requirements, namely, (1) unloading from ships or barges; (2) unloading from railway trucks; (3) conveying the material from the unloading place to the stores or direct to mills, furnaces, &c., where it has to be treated.

1.—There are practically only two methods for unloading bulk materials from ships' hatchways. One is the well-known crane method, using a skip or grab (preferably the latter); the alternative is the pneumatic method. Neither the crane nor the pneumatic plant is generally capable by itself of fulfilling requirement No. 3, but in conjunction with a band conveyor or overhead transporter a most efficient combination may be formed which will perform the double duty of unloading and conveying.

The advantage of the pneumatic unloading plant lies in the continuous nature of the duty performed and the reduction of hand labour for trimming in the ship's hold; but such a plant can, of course, only be efficiently used for practically dry and fairly fine materials. Moreover, they must not be too dusty, as, although a dust separator is fitted with pneumatic plants to ensure clean air being passed through the pump, it is not possible with some materials efficiently to cleanse the air. If the material is coarse or of heavy density, the crane and grab method is the best for unloading.

In the case of open barges it is often possible to avoid the "double handling" by the adoption of the transporter method, which will, of course, provide for both unloading and conveying. The pneumatic method has already proved most successful in the unloading of grain, cotton-seed and in some cases coal. The plant may be either fixed or portable, the latter application being particularly useful where the unloading or picking up from a heap has to be done at several points in the same works.

An outline of such a plant is given in Fig. 1, and other essential details of the pneumatic plant are shown in Figs. 3 and 4. Fig. 2 shows the pneumatic method of unloading material, which is subsequently delivered horizontally to the storage hopper by band conveyor.

It will be seen that the installation mainly consists of five units: (*a*) An air pump, driven by electric motor or petrol engine connected by a pipe to the top of (*b*) a receiver, generally combined with a dust separator. At the bottom of the receiver an "air-locked" discharger (*c*) is attached by means of which the material falls out by gravitation without the ingress of air. The transport pipe (*d*) is also connected to the top of the receiver, and at the lower end a special nozzle (*e*) is fitted, having an air by-pass.

The action is as follows: The pump sets up a partial vacuum in the receiver and causes a current of air in the

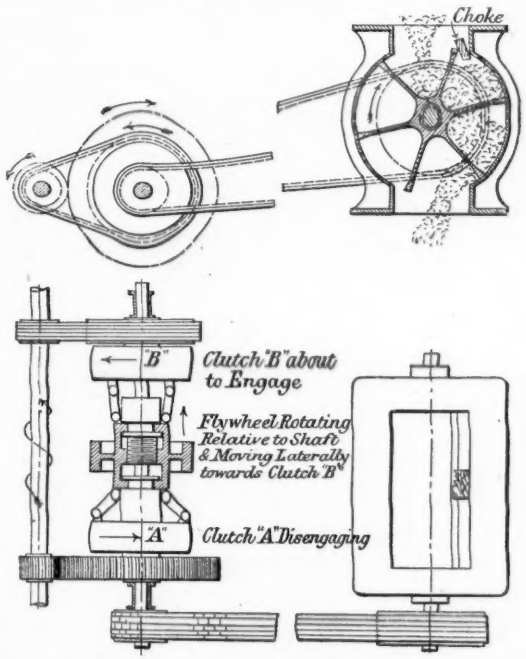


FIG. 4.—AIR-LOCKED ROTARY DISCHARGER, SHOWING AUTOMATIC REVERSING IN THE EVENT OF A JAMB AS INDICATED.

transport pipe. The air entering the nozzle at very high velocity comes into close contact with the material, which is thus accelerated by a force (proportional to the square of the air velocity) and carried into the transport pipe, where the air current continues to exert its accelerating force (although rather less than at the nozzle), and carries the material into the top of the receiver. Here the velocity of the

air falls sharply, and the material gravitates to the bottom of the vessel. The method of discharge is shown in Fig. 4. A momentum reversing gear is introduced, if necessary, between the drive and the discharged spindle to prevent damage in case any hard substance should block the discharger.

It will be seen that the clutches (loose on the countershaft) are driven in opposite directions and become locked to the shaft according to the position of the momentum wheel. In the event of a jamb causing either clutch to cease its rotation, the momentum wheel travels along the central screw, away from that clutch, causing it to disengage, and puts the opposite clutch into gear. This is a necessary provision where there is any possibility of hard lumps or large pieces of foreign matter entering the transport pipe.

2. With regard to unloading from railway trucks, provided the material is fairly small and not too dense or sticky, the pneumatic plant can be used efficiently for this duty also, but if the quantities to be handled are large and of a varied nature some form of truck tippler should be used.

3. The conveying from the unloading point can be done most efficiently by the band conveyor when the route is straight, unobstructed, and not too long ; *i.e.*, where a pneumatic plant is used for discharging as in Fig. 2. On the other hand, if the truck tippler is resorted to and the material is discharged into a pit at the side of the rails, the material has to be lifted as well as conveyed, then probably the most economical arrangement is an overhead transporter fitted with a grab, particularly if the route is not straight or where buildings and other obstructions have to be cleared. The transporter and grab will handle any class of material, but unless the quantity of material is sufficient to keep it fairly constantly employed, the capital charges might negative the other advantages. This is a simple and straightforward question to decide. It is readily seen whether any particular proposition will pay when the total tonnage to be handled is known and a survey of the site has been made.

In conclusion, it may be said that the chemical industry, as a whole, has not hitherto properly investigated its handling problems nor taken any serious notice of the many improvements and developments that have been made in unloading and conveying plant. The writer believes that this is one of the reasons why some chemical works are not so efficient as they might be.

The main objects of every industry are to cut down its cost of production, increase output, and improve the general conditions under which its work is carried on. A very great deal can be done towards the achievement of these objects by the adoption of suitable methods of handling the raw materials and products as suggested above. This particularly applies to the chemical industry and also to all industries engaged upon the production of heat and power, in which very large quantities of material have to be dealt with.

Some Practical Considerations with Handling Plant

By Alwyne Meade, A.M.Inst.C.E.

From the purely structural and mechanical standpoints there is probably no problem in the handling of industrial products which cannot be overcome. The success which will attend the installation of machinery in lieu of manual labour depends to a certain extent upon the " lay-out " and type of plant adopted, but very much more upon the nature of the material it is proposed to handle. Physically some materials lend themselves to mechanical handling extremely well ; on the other hand, other substances are liable to considerable deterioration or loss in weight. For instance, a friable material if dragged and not carried, or if discharged from some height, may be measurably affected in quality. Dry powdery substances, however, provide the greatest problem, for but little agitation is sufficient to give rise to dust (this resulting in loss), and frequently, so far as chemical works are concerned, to some injury. With effective covering-in such loss can, of course, be considerably minimised ; but, again, the means taken to reduce escape may in themselves be the cause of adding to the wear and tear of bearings and other working parts of the apparatus. Accordingly, if it is proposed to handle fine and gritty substances by mechanical means more than ordinary care must be given to the choice of suitable plant.

It must be emphasised here that when anything in the way of abnormal conditions arises it will be unquestionably to the advantage of the works manager to put his requirements into the hands of the expert rather than to attempt to design and erect the plant himself. Experience counts considerably in plant of this description, and it is only those continually having to face the many small but telling difficulties which arise in practice who can foresee unsuspected pitfalls.

Expenditure on Renewals

In this article the writer is not concerned with the merits of the various types of machinery which may be employed for labour-saving, but he is anxious to emphasise the necessity, when such machinery is in prospect, of placing the items of wear and tear and depreciation well to the forefront in those points the pros and cons of which must come up for discussion when the scheme is under consideration. In the larger industrial establishments coal and coke are by far the most common materials submitted to mechanical handling, and after these may be included various ores, ashes and clinker, phosphate, granite, gypsum, chalk, and limestone. Machinery is, of course, widely used nowadays for dealing with grain and various seeds, but these scarcely come within the sphere of the chemist.

To return to the item of wear and tear it will be found in general that the account for renewals bears some relation to the following considerations :

(*a*) Whether the material is fine and gritty or abrasive (*e.g.*, coke, breeze, clinker), or whether it is softer than the material from which the handling plant is constructed (*e.g.*, cement, oxide of iron, cereals).

(*b*) Whether the machinery is designed to drag (*e.g.*, common type of drag-chain or push-plate conveyor) or to carry the material (*e.g.*, belt conveyor, gravity bucket, telpher).

(*c*) Whether the material is hot (*e.g.*, coke discharged from coal carbonising plant, and ashes) or cold when handled.

(*d*) The materials from which the plant itself and the storage bunkers in connexion with it are made, more particularly those portions which are necessarily submitted to heat or are most prone to the influence of abrasion.

In some instances it is, of course, necessary to handle materials of a moist, sticky, or clayey nature,[1] and for these a steel band conveyor is usually to be preferred. It must be provided, however, with suitable brushes and scrapers.

It will be as well in the first place to take an extreme case for consideration, and possibly no worse conditions are met with than those arising with the handling of coke immediately on its discharge from carbonising plant at a temperature approaching 1000° C. Here we have not only an exceptionally abrasive material at a high temperature, but the necessity for quenching down gives rise to a considerable volume of steam which in itself has a deteriorating influence. It is undoubtedly owing to the factor of wear and tear that

[1] *The Chemical Age.* Vol. I., II., p. 296.

machinery for this purpose is of only comparatively recent introduction, for engineers naturally hesitated to employ moving parts constructed of iron and steel, which, in addition to withstanding abrasion, were faced with rapid contraction and expansion owing to the comparatively sudden changes of temperature resulting from the quenching process. In connexion with the handling of hot materials Zimmer[1] has stated that steel band conveyors are excellent for the purpose; and, among other substances, they are used for hot calcium carbide and calcium chloride. With hot and abrasive materials the writer much prefers to employ plant which carries and does not drag the material, and with which the structure forms a very much greater part of the whole than does the machinery, *e.g.*, the telpher.

While speaking of telphers it might be as well to correct the rather prevalent impression that these machines have so far been almost solely confined to the handling of coal and coke. Certainly, so far as the chemical works in this country are concerned, the writer can point to no actual instance of their use, but in Germany a number of examples[2] are to be found. Thus at the works of Frederick Bayer & Co., at Leverkusen, telphers are used for handling salt, sodium nitrate, and pyrites, while at the Biebrich works of H. & E. Albert they are employed in connexion with superphosphates.

It will be agreed that in the modern works the peace of mind of the officials in charge is a factor which deserves consideration, and when apparatus is contemplated for installation under anything but amenable conditions it is as well to take heed as to whether it may give rise to anxieties, such as breakdown, from which man-handling may normally be said to be free. In other words, will the reduction in labour effected relieve the works manager of difficulties not actually measurable in terms of money, or will the machinery add to such difficulties?

Speed and Density

It is quite a common experience to find that the ordinary conveyor or elevator is not operating at a maximum efficiency merely owing to the designer having overlooked the important relation between the density of the material handled and the rate of travel. With inclined conveyors, too, density has some considerable influence in determining the angle of slope. Machinery dealing with vegetable matters of low specific gravity can be driven at much higher speeds than that made use of for such substances as coal. For heavy materials the angle of slope (with the horizontal) should lie between 45° and 60°, and the speed should not exceed 130 ft. per minute under any circumstances. When a friable material such as coke is being dealt with the speed of an elevator of the bucket type should be low, because a high velocity of delivery entails considerable breakage of the material, in addition to curtailing the life of the receiving shoots. In general, it may be said that coke elevators should not be operated at a greater speed than 60 ft. to 90 ft. per minute.

All such points as those briefly outlined above have their relation to the wear and tear expenditure, and as the band conveyor still retains its popularity it is as well to add the reminder that when materials of higher densities are handled the band must be considerably stronger (than where lighter substances are concerned) in order to withstand the greater weight imposed upon it. Moreover, as the middle portions of the width (not the outer edges as so frequently supposed) show the greatest tendency to wear they require special care in their preparation. As an instance of the manner in which considerable renewal expenditure may result from comparatively insignificant and unlooked-for sources the writer feels that his own experience with a very large band-conveyor installation may be instructive. In this case the belt sections were joined together by means of ordinary flat plate hinges riveted to the belt. On one or two occasions these hinges snapped; and, before the machinery could be stopped, they ripped up the canvas belt for some considerable length. The significance of this will be understood when it is mentioned that the cost of this particular belt is 20s. per ft. Eventually the plate fasteners were replaced with flexible hinges of the "alligator" type, and no further trouble was experienced. The life of the belt, in fact, is now approximately six years.

[1] *The Chemical Age.* Vol. I. 15, p. 406.
[2] *The Chemical Age.* Vol. III., 60, p. 150.

Storage Receptacles

Not the least important portion of a mechanical handling installation is the hoppers and storage receptacles, and if the material is of hard, angular, and abrasive nature these may quickly show signs of deterioration. The writer's experience is that $\frac{3}{16}$in. mild steel plates over which coal or coke is continually running may require renewal after a period of twelve months. The conical bases of storage hoppers are quickly affected if made from steel, while if the material is hot (*e.g.*, imperfectly quenched coke), the side plates buckle locally, and once they have lost their shape they are particularly prone to wear in patches. When all things are considered there can be little hesitation in recommending concrete in those cases where hard and moderately dense materials are to be stored. The structure, if the reinforcement is of a complicated nature, may be comparatively costly in the first instance; but the additional outlay is more than balanced by subsequent saving in painting and renewal; and—so far as one is able to say from experience as yet available—the life of a reinforced concrete structure is unlimited. The writer has recently had a good deal of experience with a large installation of reinforced concrete hoppers, some of which are employed for what is probably the worst condition which can be met with, namely, the reception of hot coke and the quenching thereof. Experience has shown that ordinary ballast concrete is liable to flake when coming in contact with direct heat, and damage to the structure may result. In this instance a satisfactory solution was found in the employment in the interior of the hoppers of a $\frac{1}{2}$ in. rendering of finely-ground clinker (preferably washed) and cement, the material being made up of three parts of ground clinker to one part of cement.

When coke in the cold state only has to be dealt with the wear and tear of the interior faces of concrete hoppers is not so severe, but even then it is advisable to protect it with a layer of material of a harder nature than ordinary ballast concrete. One method is to plaster the interior with a rendering made from small granite chips and cement; but, although it is rather more costly, the writer much prefers to adopt the policy of using 1-in. blue Staffordshire tiles. A word of warning might here be included in connexion with the use of concrete made from coke-breeze and cement. Such concrete occasionally shows a tendency to swell, the rapidity of the increase in volume largely depending upon local conditions. In one case recently the writer had to deal with a storage floor which was composed of parallel r.s. joists with breeze concrete filling. Through expansion of the concrete the floor gradually underwent elongation, and threatened to push outwards the gable ends of the building. The trouble was eventually overcome by cutting out one bay of concrete in every nine, thus breaking up the longitudinal thrust, by freeing the cross joists at their extremities, and by bedding each one on a mild steel plate so as to permit of independent movement of the whole floor in the event of a continuation of the expansion. Breeze concrete, however, does not always behave in this manner. In fact, the occurrence may be looked upon as rare. It has been ascribed[1] by one authority to the fact that a certain amount of limestone may have been present in the original coal, that this has become calcined in the process of making the breeze and has thus been converted into quicklime.

[1] *Engineer's Year-Book*, 1921. VIII., p. 385.

Conveying Machinery in the Chemical Industry

By George Frederick Zimmer, A.M.Inst.C.E.

Articles by the same writer have previously appeared in this journal, under the title of "Mechanical Handling of Chemical Material," Nos. I., II., III., and IV., in the issues of August 20 and September 6, 20, and 27, 1919. In the present article the subject is dealt with from different aspects.

In order to deal fully with the subject in hand in some rotation, we will treat it under two heads :

(*a*) The setting forth of a fundamental principle which should underlie the economical employment of labour-saving devices ;

(*b*) A review of the most suitable mechanical handling devices for specific purposes of the chemical industry in this country or abroad, based on actual practice.

(*a*) The Fundamental Principle

However necessary the handling of material may be, the operation must increase the gross value of the objects handled without, however, increasing their intrinsic value. In other words, all expenditure in handling operations in any industry is unproductive ; in fact, such operations often depreciate the material in quality and lessen it in quantity. Such expenses must, therefore, be kept as low as possible.

Whenever moving raw materials, or such in course of manufacture, from one place to another, they should be laid down at the spot where they will be used, or at a spot from which they will gravitate down to it without any manual

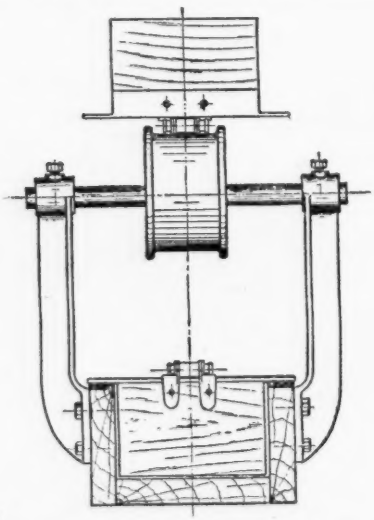


FIG. 1—CROSS SECTION THROUGH PUSHPLATE CONVEYOR, WITH PITCH PINE TROUGH AND PLATES.

effort. Gravity should be made use of for handling wherever possible. The routeing of all materials through all departments must be on the shortest and most direct paths in order that handling operations may be both few and short.

While these suggestions combine the most favourable conditions toward the attainment of success, it is often only possible to carry them out in a new lay out, though much can be done in existing plant, and the observance of any of the points will be a help at the present period, when the cost of manual labour is so excessive. Nearly all that has been said refers equally, whether manual or mechanical labour is employed. One further condition might be added —employ the machine instead of brute force wherever possible, and man as the brains thereof.

When material is manually transported in the chemical industry it is handled by shovel, in barrels, pails, and by pumps, &c. It is obvious, then, that if mechanical means are to take the place of such manual labour a great diversity of widely differing conditions have to be met, especially as the materials to be dealt with may be hot, inflammable, friable, or even explosive. Unless hygroscopic, materials arriving in bulk at the factory can be handled by the well-known standard conveying machinery, which is likewise applicable where goods in cases, cans, barrels, and carboys are concerned.

Important as mechanical devices are in the economical development of the chemical industry, they are not infrequently debarred on account of the detrimental effect which iron and steel have when in contact with some chemicals, a defect which causes discoloration by rust. In order to obviate this, hard wood, copper, brass and lead have hitherto been employed for such parts of handling machinery which come into direct contact with chemicals. Wood, except for conveyor troughs and plates for conveyors of the push-plate type, is a most unsuitable material, not only because of its lack of hardness, but also because it often cannot be wrought into the necessary form. A section through a push-plate conveyor with pitch-pine trough and plates is illustrated in Fig. 1. The metals, copper and brass, are debarred on account of expense, while lead is not suitable because of its softness.

All this is now altered by the introduction of stainless iron and steel, and from inquiries the writer has made he is able to state that elevator buckets, troughs for pan and reciprocating conveyors and the scrapers of push-plate conveyors, can all be prepared from this stainless steel, while a new kind of cast-iron known under the name of "Ironac" and "Tantiron" in this country, and "Duriron" in America, is now obtainable, which resists all ordinary acids of commerce, and is already largely in demand for pipes and retorts in chemical works. Such iron need not, therefore, be galvanised for protection against weather, &c. This non-rusting iron and steel has an importance which is as yet barely appreciated. It is now possible for practically all modern conveying devices to be made use of in the handling of a great many chemical substances which could not formerly be so handled except either at prohibitive expense in first cost, or in the upkeep of plant constructed of materials unsuitable from the mechanical aspect.

A form of reciprocating conveyor was much used in salt works a few years ago and may still be in use ; its only drawback was the corrosion of its parts. With rustless iron and steel at our disposal the same type of conveyor may now become a serviceable adjunct to a number of mechanical processes which had formerly to be performed by hand.

(*b*) Mechanical Handling in Chemical Works

In the paper industry, apart from pulp wool, which is the principal basis, clay and lime have to be handled—the former as a filler for the paper and the latter for use in connection with the bleaching plant.

A device, known as the "V" conveyor, which works in both a horizontal and vertical direction, is of some interest in the chemical industry. It may be employed, not only for moving chemicals, even if slightly sticky, but also for wood and bark chips. An interesting example of this is in use in the large paper mill of the Dill & Collins Co. of, Philadelphia, as shown in Fig. 2. At the lower right hand corner is a log chipper, which delivers on to the lower horizontal run of the device, where the V-shaped buckets on their sides act as scrapers. During the ascent of the buckets

they are in their normal position and carry the material to the top where the chain of buckets runs again horizontally, either in a trough scraping the material along, or passing over a hopper into which they discharge the material, as in the case of the illustration, which represents a chip-handling screen in a paper-mill. It should be understood, however, that the upper and lower horizontal run may be 50 ft. or even 100 ft. long in order to deliver at a number of points into a battery of receptacles. The V-shape of the buckets is such that the material rests but lightly in them, and therefore falls out easily on a horizontal path, even if somewhat inclined to adhere.

White china clay, which is also handled in this paper mill, is not easy to deal with when wet, but at the state of dryness which permits crushing, at which it is generally delivered

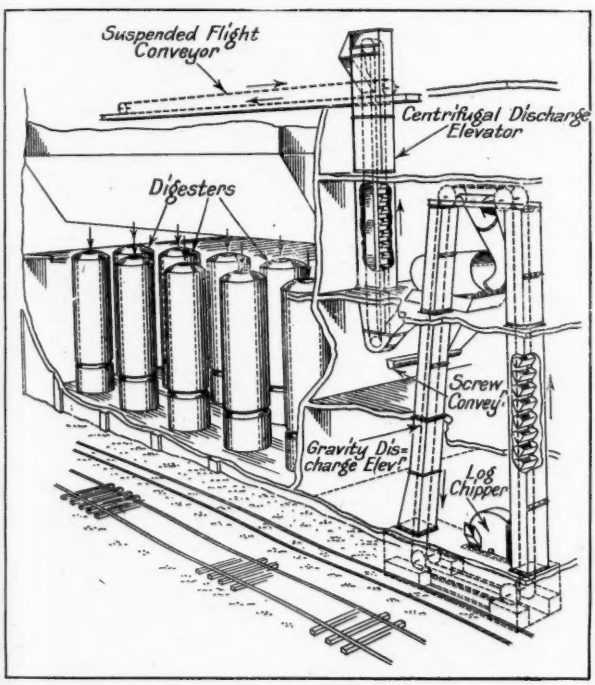


FIG. 2.—HANDLING LOG CHIPS BY "V" BUCKET ELEVATOR AND CONVEYOR.

at paper and other works, it may be handled by a cotton-rubber band conveyor, ordinary bucket elevator and worm conveyor.

When handling lime for bleaching purposes, for instance, in paper mills, a similar equipment to that in use for clay may be used, but a push-plate conveyor is frequently preferable to a spiral conveyor.

Bucket Elevators

If bucket elevators are to be used for handling salt, the buckets should be shallow, attached either to chains or rubber cotton belts. Opinions differ on the latter point, and while the writer knows that a firm of great repute in this country provide all their salt elevators with malleable cast chains, he cannot help thinking that a compound cotton-rubber belt would be better in all cases where discoloration by rust is detrimental. Such an elevator with a textile rubber band can, moreover, be housed in a wooden casing, while one, chain operated, would require a cast-iron casing. One of the latter is illustrated in Fig. 3, showing the whole of such an elevator, as well as a large scale section through the troughing. This machine has done excellent service in elevating salt. It varies from ordinary elevators in so far as the lower strand is utilised as the lifting side, combined with a peculiar arrangement of tapping or dumping wheels at the top, in order to improve the efficiency of the discharge.

Regarding the buckets, these can be galvanised, sherardised, enamelled, or dipped into a mixture of tar and pitch when hot to give them a non-corrosive coating. The last method

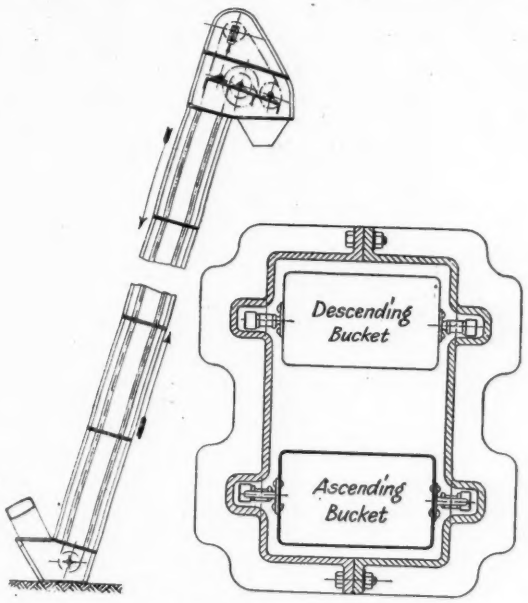
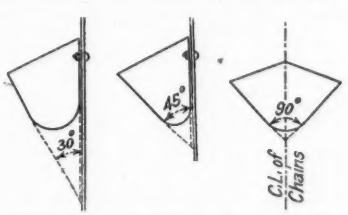


FIG. 3.—GENERAL VIEW AND CROSS SECTION OF SALT ELEVATOR IN CAST-IRON CASING.

is certainly the cheapest, but buckets stamped out of stainless iron would be the best. Buckets of non-staining iron and steel have not, so far as the writer knows, yet been tried, but one is certainly justified in anticipating a success.

With regard to the shape of the elevator buckets, they should be shallow for material at all likely to stick. This will be apparent when we realise that with material ascending in the bucket of an elevator, the ever present vibration of machinery in motion has a tendency to shake such material more or less tightly into the bottom of the bucket. This tendency is more pronounced the more acute the angle of the bucket. For ordinary free-running stuff, the angle of the bucket should be 30 deg. (Fig. 4). A bucket



FIGS. 4, 5, AND 6.—THREE TYPES OF ELEVATOR BUCKETS.

with an angle of 45 deg. (Fig. 5) gives such a support to soft and sticky material that it cannot shake down to the same extent and at the top it delivers freely. A V-bucket elevator has buckets with angle of 90 deg. (Fig. 6), which is still more favourable, and this type should therefore be employed for material which is still more inclined to stick. Moreover, it has already been shown that with this type of elevator the buckets can be detained in an unloading position for any length of time to suit the most obstinate cases.

Bucket elevators frequently give trouble because they are not uniformly fed, one bucket having an overload, while another may be half empty. It is essential, particularly with material inclined to stick together, that just the

correct amount should be handled by each individual bucket For this purpose mechanical feeding devices are employed;

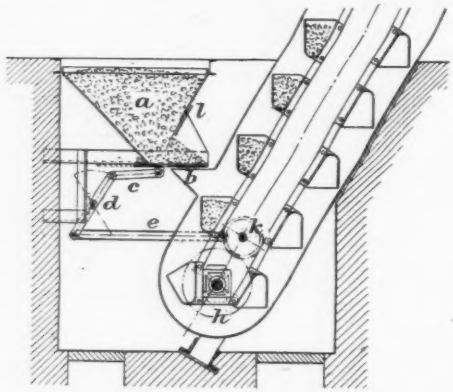


FIG. 7.—FEEDING DEVICE FOR BUCKET ELEVATORS.

one of the best the writer is acquainted with is shown in Fig. 7.

Use of Gravity

Materials difficult to handle should preferably be raised in one operation to a level from which they may be distributed by gravity through one or more processes without rehandling.

Conveying by gravity when material has once been raised is the most rational and least expensive operation, because the incline of the shoot or trough may be adjusted to the nature of the stuff, and since it involves no mechanical parts it is of advantage that a gravity shoot can be made without great expense, and of any substance which will resist any destructive tendency of the material to be conveyed. The power expended in elevating the material a few feet

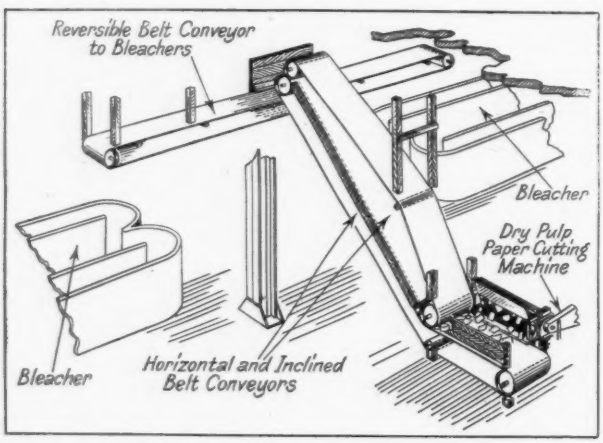


FIG. 8.—ELEVATOR IN WHICH PAPER PULP IS RAISED BETWEEN TWO TRAVELLING BANDS.

higher is often infinitely smaller than the expense of employing horizontal conveyors.

Where it is preferable for the material not to come into contact with metal elevators it can be raised sandwiched between two belt conveyors, if it does not contain large pieces. Such a case is illustrated in Fig. 8.

Reciprocating Salt Conveyor

Common salt, as is well-known, is not only much used in the chemical industry, but it affords a typical example which is applicable for quite a number of other chemicals. The handling of salt by a variety of mechanical devices is, therefore, here given in the hope that these examples may be useful to the chemical engineer in his choice of handling machinery for such or similar materials.

For ordinary freely running and dry material, the band conveyor can be used with impunity, both troughed and flat, but for material like salt, during the manufacturing stage, it requires considerable modification. Mr. George E. Willcox, an American gentleman who has had much experience in salt handling machinery, says that on a dry day the salt (and this applies to many other materials) may be apparently dry and almost similar to granulated sugar in its behaviour on conveyors, but with increased humidity in the air the salt may become soggy, and on very damp and foggy days it will even drop brine from the conveyors. If the conveyor is a belt, then the salt can be easily cleaned off on a dry day by means of a diagonal scraper of plate glass, but on a wet day it will stick to the belt, so that it is exceedingly difficult to remove it by cleaning devices, such as scrapers and rotary brushes.

Another difficulty encountered with belt conveyors having iron rolls is excessive corrosion. The under side of the belt, becoming covered with iron rust sooner or later, under the sweating of the salt, drops rusty water and pieces of discoloured salt on to the salt piles. It has, therefore, been found advisable to dispense with iron as much as possible

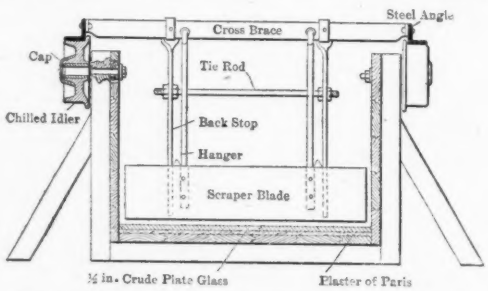


FIG. 9.—CROSS SECTION THROUGH SALT CONVEYOR.

in the construction of belt conveyors for carrying salt during manufacture. In Mr. Willcox's opinion, the most satisfactory means are idler rollers of hard wood, pepridge for preference, 5 in. in diameter, and not less than 3 in. longer than the width of the belt.

One difficulty, which seems inherent in the use of conveyor belts which must be continuously in use for handling salt, is an accumulation of dirt particles which drop from the conveyor and discolour the salt on the pile. The exact cause of the accumulation of dirty salt along the edge of the belt and the winding of streaks of black salt around the peripheries of the rollers just at the edges of the belt is difficult to explain, even after careful investigation, except on the theory that the moist belt, passing through the air in the course of the day's run, picks up particles of dirt and soot which ultimately work to the edges and wind around the rollers until they have accumulated sufficiently to fly off and drop on to the salt below.

As a result of such difficulties in conveying bands, a different type of conveyor has been adopted for this condition by Mr. G. E. Willcox at the salt plant under his charge, *i.e.*, when a small stream of salt must be taken continuously

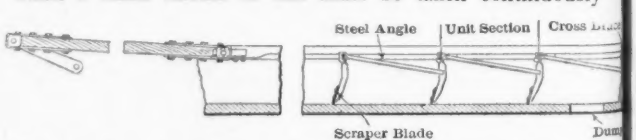


FIG. 10.—SIDE ELEVATION OF SALT CONVEYOR (REDUCED SCALE).

from the plant and delivered on to the warehouse floor. The new conveyor of the reciprocating type is shown in Fig. 9, representing a cross section, while Fig. 10 is a

longitudinal section to a smaller scale, showing also the crank and connecting rod for manipulating the scraper blades. Such a conveyor, 200 ft. long, is actuated by one driving gear, and it is believed that a length of even 300 ft. is possible. The machine here described—2 ft. wide and with angle supports 2 in. by 2 in. by ¼-in., with steel blades—has been satisfactorily in use for four years, taking the salt from eleven grainers, each 13 ft. wide and 176 ft. long. The conveyor can also be manipulated by hydraulic cylinders instead of a crank.

Viscous and Semi-liquid Substances

No hard and fast rule can be given concerning the handling of sticky materials, since this depends upon their degree of stickiness. Some materials are in reality adhesive, while others are only apparently so. It will, therefore, suffice to say that for the latter kind quite a number of the standard handling devices are applicable, or sometimes slight modifications will render them so. For instance, moist and apparently sticky materials can be conveyed by a band or tray conveyor if it is kept clean by a stationary or revolving brush. If delivery at intermediate points is desirable a push-plate conveyor or a tipping-tray conveyor are better than a band conveyor on account of the difficulty of cleaning the band before it negotiates the throw-off, when it has to pass a curve, like the letter S, over two guide pulleys in such a way that any of the material which adheres to the band will pass with the band between it and the second guide pulley, which is detrimental to the life of the belt and also causes other troubles. Delivery of a band conveyor over the end is quite sound practice with slightly sticky materials, especially if the band be fitted with a brush which cleans it before it starts on its return run.

What is known as a shuttle conveyor may sometimes be used for effecting delivery at a number of intermediate points without a throw-off. This is done as follows : A self-contained band conveyor, complete with its motor, is mounted upon wheels on a rail-track, so that the conveyor can be pushed bodily to receive the feed at any part of its length with the delivery plumb over the destination of the material.

Any sticky substances or semi-liquids are always best dealt with in containers of a size which can be easily handled by a boy.

The gravity tray conveyor will answer both for elevating and conveying. Paint in tins can be handled in this way ; since the trays are always upright the containers will remain in an upright position until they are taken off. When conveying on a level or slightly inclined path is necessary, particularly where the path is tortuous, it often pays to have one large self-dumping container on an accumulator chassis, which can ply between the point of production and that of consumption. Both large and small containers require some help in emptying. Small containers, holding only a few pounds, may be conveyed on an endless stitched or solid woven cotton band running in the bottom of a trough.

By the employment of large terminal pulleys or two additional smaller ones, the upper and lower run of the belt

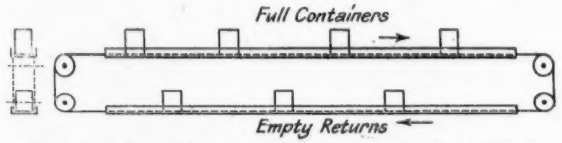


FIG. 11.—BAND CONVEYOR FOR CONTAINERS FOR STICKY MATERIALS.

can be placed sufficiently far apart that the empties can be returned on the lower run of the same device (Fig. 11).

When the distance of the delivery does not exceed 50 ft., or thereabouts, containers, full and empty, may be conveyed on gravity roller runways between the two points ; this would require a fall in favour of the load of 2½ ft. to 3 ft. in 50 ft. If the full containers are therefore placed on the upper end of such a runway, say, 2½ ft. to 3 ft. above ground level, they would reach their destination by gravity at the ground level, where they could be emptied, and the empty containers raised to a similar runway also having its feeding

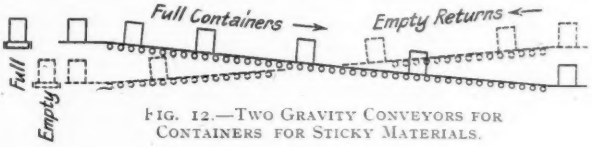
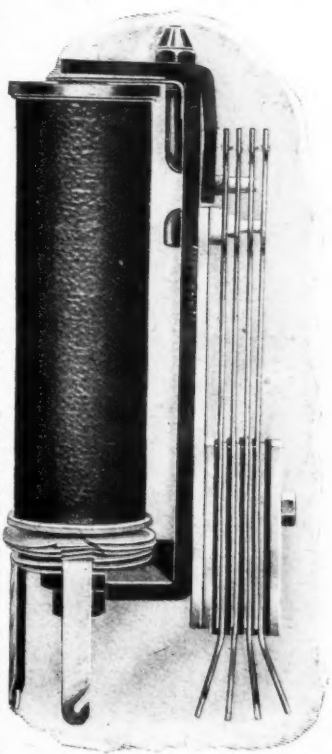


FIG. 12.—TWO GRAVITY CONVEYORS FOR CONTAINERS FOR STICKY MATERIALS.

end 2½ ft. to 3 ft. above ground (Fig. 12), and reaching the filling point again at the ground level, the whole operation being performed without the expenditure of any driving power.

The Growth of Automatic Telephony

IT is to the credit of British telephone engineers that they have evolved an automatic system which entirely eliminates electro-mechanical switches, and by utilising very small electro-magnets with a maximum armature of $\frac{1}{32}$ in. and which are known as " Relays " (see illustration), have produced a system which is actuated solely by electricity without the aid of any cumbersome mechanical devices. By means of this invention every caller becomes his own operator. A connexion can be obtained in a few seconds even in exchange of 10,000 lines, which gives not only clear but secret transmission, and upon replacing the receiver instantaneous disconnection is obtained. Moreover, it is impossible to get a wrong number, and, above all, by utilising this system for internal communication, there is a large saving in connection with operators' salaries and other incidentals.



Although it would be unreasonable to expect the State to scrap millions of pounds worth of telephone equipment, the British postal authorities have already so far recognised the advantages as to install automatic plants in various centres, and they are installing " Relay " automatic telephones in others. They also install, on a rental basis, automatic telephones which give both internal and external service to subscribers.

In America enormous progress has been made in this field, and, very shortly, in New York City alone, the work will begin of transferring some 900,000 lines to the automatic system. Australia and New Zealand also have automatic systems in operation, while even in Honolulu there are 9,000 lines operating 75,000 calls per day on an average. India is installing " Relay " automatic telephones in some twenty important exchange centres. In England, however, there are still only some 27,000 automatic telephones out of a million lines in operation.

Meantime, the example of the Admiralty and leading engineering and commercial firms in installing automatic telephones may have a good effect in educating the general public in many advantages of the automatic telephone.

Automatic Coal and Ash Handling Plant

By E. W. L. Nicol, M.I.Mar.E., A.I.E.E.

In modern industry the whole question of fuel economy is inseparable from that of automatic coal-handling, stoking and ash-removal machinery. The high cost of fuel and the imperative need for its conservation necessitates a fuller utilisation of the lower grade, but relatively cheap, classes of small coal, the production of which is an unavoidable concomitant of coal-mining.

Coal slack is, in fact, an inevitable by-product, produced in the winning, screening, and grading of the primary product, the price of the latter, as in other industries, being largely conditioned by the revenue derived from the secondary product.

A ready market for and the prompt disposal of coal slack has, therefore, a very important bearing upon the price charged

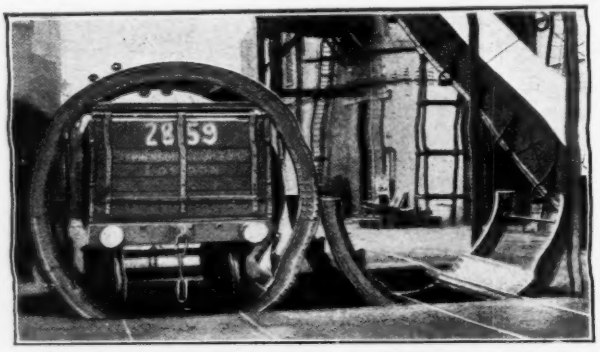


Fig. 1.

for higher classes of coal, which are also used in industry, so that it is in the interest of industry generally that coal slack should be utilised to the fullest extent.

One result of the increased cost of labour and transport is a growing accumulation of waste fuel in colliery districts, and also an increased proportion of slack left in the mines as unmarketable and not worth bringing to the surface—truly a deplorable state of affairs when industry is more than ever dependent upon cheap fuel.

The problem of the full utilisation of the smaller non-coking coals is indeed one that demands attention. It has frequently been pointed out that in certain mines where the coal is loaded with 1½ in. forks, all coal less than 1½ in. is rejected and left to be buried in the mine. The result is that millions of tons of valuable fuel are left underground and are lost to the nation.

The correlation between a stabilised market for slack and cheap coal on the one hand, and, on the other, the interdependence of the various branches of industry, should be sufficient incentive, apart from its undoubted economy, to utilise the lower-grade classes of coal; but the fact is that among large consumers in towns and cities the relatively scarce and high-priced washed and graded coals are rapidly growing in favour.

One reason of this preference, which eventually must operate in a way inimical to the best interests of all concerned, is to be found in the difficulty often experienced in utilising efficiently the cheaper but lower-grade fuels.

Apart from the problem of unloading, conveying and storing, which is common to all classes of coal, there is, ordinarily, with low-grade slack, greater difficulty in maintaining efficient combustion and in ash removal. These difficulties have, however, largely been overcome by the development of the automatic stoker and ash-removal plant; and, in the following notes, it is proposed to describe and illustrate some of the latest installations of plant of this kind.

Tracing the operation from the arrival of the truck in the coal siding, there is, first, the rotary truck "tippler," as designed by Messrs. Ed. Bennis & Co., Ltd., to empty trucks of 10, 15, or 20 tons capacity at a rate of from 60 to 100 tons per hour (Fig. 1).

By this system the loaded truck is turned over bodily, the contents being deposited through a crusher, if necessary, into a bunker, and passing thence to a conveyor. The centre of gravity of the loaded truck is approximately at the centre of the tippler-rings, balance weights being fixed at the top to counteract the weight of the frame and the empty truck. The complete revolution of the tippler eliminates the necessity for trimming, and the last ounce of coal is emptied expeditiously and at the minimum of cost in manual labour. In conveying the coal to overhead storage bunkers, so many different methods have been perfected, each specially applicable to different requirements and local conditions, that this branch of the subject in itself warrants the most complete investigation. Only passing reference will therefore be made to types of coal conveyors recently embodied in the design of important power plants. These include the gravity bucket conveyor and the "U" link conveyor.

Fig. 2 gives a good idea of the flexibility of the steel "U" link conveyor, and the ease with which it may be used on comparatively steep gradients. In this particular instance, the right-hand conveyor is conveying ash to the railway truck, and the left-hand conveyor is conveying coal from the rotary tippler to the automatic stoker hoppers.

The lower part of the chain moves inside a rectangular trough and carries the coal with it. Openings, with hinged doors, are placed at desired intervals, through which the coal drops into bunkers or direct into the stoker hoppers, thus eliminating the necessity for manual trimming. This

Fig. 2.

arrangement permits also of the segregation of different kinds and classes of fuel in separate bunkers for use later, "sandwiched" or blended in any desired proportion. The importance of this feature, and its bearing upon the efficient operation of power plant and the utilisation of low-grade

fuels, such as coke and coke breeze, is now fully recognised by many power-station engineers.

From the overhead bunkers, the coal is fed to the stoker hoppers through automatic weighing machines and chutes. In both electric and hydraulic power stations, where the patent Sandwich system of fuel blending has been adopted, duplicate chutes, communicating with separate overhead bunkers, have been provided. This arrangement facilitates

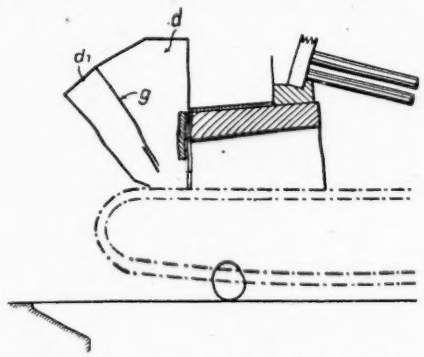


FIG. 3.—DIAGRAM OF PATENT "SANDWICH" SYSTEM OF FEEDING COKE AND COAL APPLIED TO CHAIN GRATE STOKER.

d_1, coke hopper; d, coal hopper; g, adjustable dividing diaphragm.

the "sandwiching" of coal dust, or low-grade slack, along with coke or coke breeze. The Sandwich system also facilitates the use of anthracite grains in conjunction with bituminous slack, or mixtures of slack and "nuts," fed in superimposed layers. By means of this development of the mechanical stoker, fuels, hitherto regarded as unsuitable, are not only rendered available, but are consumed at higher rates per square foot of grate area, and with greater efficiency than has hitherto been found possible under natural draught conditions.

Reference to Figs. 3 and 4 will show the extreme simplicity of this system. From a divided feed hopper, coke or coke breeze, is fed on to the moving grate in a layer of any required thickness from hopper d_1. From the hopper d, low-grade coal slack is fed on top of the coke layer, the proportion of

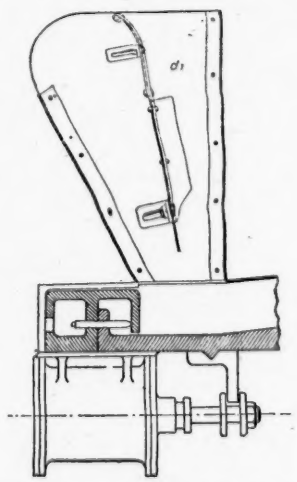


FIG 4.—"SANDWICH" SYSTEM OF FEEDING COKE AND COAL APPLIED TO CLASS E UNDERFEED STOKER.

coal being regulated by means of the guillotine door in the usual manner. The burning volatile matter distilled from the coal maintains the ignition arch at a sufficiently high temperature to ensure continuous and satisfactory ignition of the coke as it enters the furnace. Used alone, low-grade bituminous coal tends to cake on the links of chain grates, this causing the formation of smoke by preventing the quantity of air necessary for complete combustion from being drawn in; hence a smouldering mass travels along and is dumped into the ashpit only partly consumed. With the Sandwich system, the coal is borne on top of the porous coke layer, and it is not only burnt completely, but produces no smoke.

	Test No. 1 Coal and Coke.	Test No. 2. Coal only.
Calorific value as fired	11,138 B.Th.U.	12,150 B.Th.U.
Fuel consumed per grate ft. hour	30.66 lb.	31.66 lb.
Ash and clinker, actual	16.22 %	12.7 %
Average steam pressure	178 lb.	179 lb.
Super-heat temperature	486° F.	490° F.
Water evaporated per hour	10,505 lb.	8,747 lb.
Water evaporated per sq. ft. of heating surface	5.22 lb.	4.35 lb.
Water evaporated per lb. of fuel as fired from feed temperature	7.18 lb.	5.76 lb.
Water evaporated from and at 212° F.	9.22 lb.	7.44 lb.
Efficiency: boiler and super-heater	69.9 %	53.12 %
Efficiency: boiler with economiser	79.96 %	60.98 %
Draught over fire	0.25 in.	0.25 in.

Comparative Test results obtained with (1) coal and coke fired on the Sandwich system and (2) coal only, under B & W water-tube boiler of 2,010 sq. ft. heating surface.

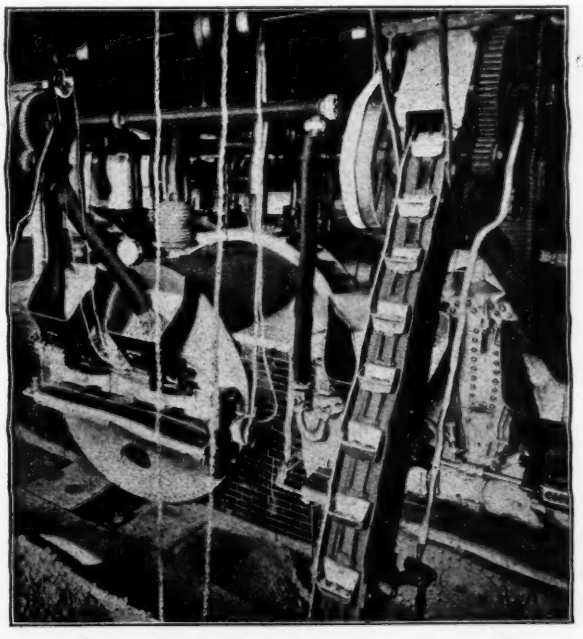


FIG. 5.—"BENNIS" BUCKET ELEVATORS AND MECHANICAL STOKERS.

In cases where the coal is stored on the firing-floor level bucket elevators are provided, one for each pair of mechanical stokers (Figs. 5 and 6). These machines require little or no attention, and they tend very materially to reduce the stoke-hold staff necessary for a given output of steam.

Similar electrically-operated bucket elevators are now also largely used for loading coal from outside reserve stocks.

Passing now to the removal of ash and flue dust from boiler ash-hoppers and boiler and economiser flues, it will be seen that not only is the manual labour reduced to the minimum by the adoption of modern appliances, but the arduous task of handling hot and dusty refuse is rendered less unpleasant.

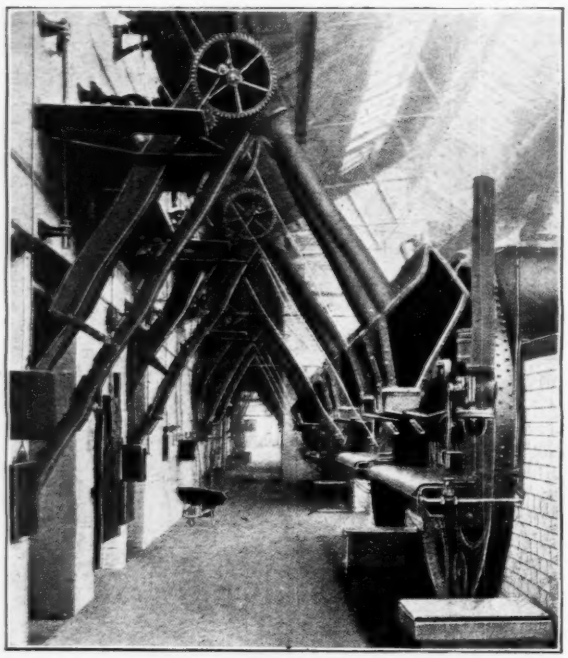


FIG. 6.—INDEPENDENT BUCKET ELEVATORS FEEDING MECHANICAL STOKERS

This plant consists of an exhauster, foul-air cleaner, ash receiver, and pipelines, as required, for taking ash or other material to the receiver, and it can be arranged for any number of boilers, so as to take the ashes therefrom and deposit them in an ash receiver (Fig. 7).

The efficient combustion of low-grade solid fuels (or, for that matter, any kind of finely-divided solid fuel) at high rates per square foot of grate area, necessitates the application of mechanical draught, either "forced," or "induced,"

FIG. 7.—ASH SUCTION PLANT.

or both. By this means only can the desirable "balanced" atmosphere be maintained in the combustion chamber, and the inleakage of air be effectively prevented.

Reference may also be made to the latest development of the Underfeed Stoker Co.'s self-contained travelling-grate mechanical stoker and ash conveyor, which are designed for use with low-grade bituminous or non-volatile fuels, such as anthracite smalls, coke and coke breeze. The following table of results, obtained with this company's mechanical stokers at an important power station, serve to emphasise the importance of economics to be effected by using the lower-grade small coal, coal slack, anthracite grains, and coke breeze. Proximate analyses of these fuels, which are fairly representative, are also given.

Date of Test	October 26th, 1921		October 27th, 1921		October 28th 1921	November 4th 1921	
Name of Coal	Glamorganshire. Small Coal		Gloucestershire. Slack Coal		Coke Breeze	Anthracite Grains	
Analysis of Coal	Ash, 14.03% Volatile, 17.48% Moisture, 1.24% Fixed Carbon, 67.25% B.T.U. as fired, 12,268		Ash, 12.64% Volatile, 19.15% Moisture, 1.28% Fixed Carbon, 66.93% B.T.U. as fired, 13,138		Ash, 25.03% Volatile, 6.82% Moisture, 13.68% Fixed Carbon, 54.47% B.T.U. as fired, 8,927	Ash, 22.55% Volatile, 7.94% Moisture, 1.94% Fixed Carbon, 67.57% B.T.U. as fired, 10,790	
Duration of Trial, hrs.	6 full load	1 overload	6 full load	1 overload	6 full load	6 full load	1 overload
Steam Gauge, lbs.	202	205	200	210	200	200	200
Draught Gauge, Damper, in. w.g.	.5	.5	.5	.5	.3	.3	.3
Absolute Steam Pressure, lbs.	216.7	219.7	214.7	224.7	214.7	214.7	214.7
Air Pressure in Windbox	.5	.8	.6	.8	.6	.6	.7
Gases leaving Boiler, °F.	577	575	555	570	553	590	590
Feed Water entering Boiler, °F.	135	127	100	100	240	96	100
Steam, °F.	522	527	562	566	538	568	568
Superheat, deg.	139	143	174	174	150	180	180
Total fuel consumed, lbs.	18,144	3,472	16,128	2,912	19,264	18,2568	3,136
Total refuse dry, lbs.	2,916	439	2,038	368	4,956	4,92	980
Total refuse dry, per ct.	16.97	12.64	12.64	12.64	25.72	27.02	31.25
Fuel as fired per hour, lbs.	3,024	3 472	2,688	2,912	3,211	3,043	3,136
Fuel as fired per sq. ft. of grate, lbs.	26.52	30.45	23.58	25.54	28.16	26.69	27.45
CO_2 in gases leaving Boiler %	13	14	12	11.5	13	13.5	12.5
Total Weight Water used, lbs	155,106	32,000	139,400	26,000	116,000	120,000	20,500
Factor Evap. Boiler including superheater	1.21	1.22	1.27	1.27	1.11	1.27	1.27
Total from and at 212° including superheater, lbs.	187,678	39,040	176,038	33,020	128,760	152,400	26,035
Amount used, lbs.	25,851	32,000	23,233	26,000	19,333	20,000	20,000
Evap. from and at 212° including superheater, lbs.	31,279	39,040	29,506	33,020	21,459	25,400	26,035
Evaporation per lb. actual, lbs.	8.54	9.21	8.64	8.93	6.02	6.57	6.53
Equiv. from and at 212 °including superheater, lbs.	10.34	11.23	10.97	11.34	6.68	8.34	8.29
Evap. from and at 212° per sq. ft. heating surface, lbs.	5.79	7.22	5.46	6.11	3.97	4.7	4.82
Efficiency of Boiler	81.39%		80.79%		72.36%	74.73%	

Electric Capstans for Haulage Purposes

FOR the haulage of railway wagons in private sidings and for trucks in foundries and workshops the electric capstan is coming into increasing use. The main essentials in an electrically-driven capstan are simplicity of operation; the ability to withstand momentary overloads without fear of breakdown; accessibility of working parts; minimum wear on ropes; a locking device to prevent unauthorised use; and a capacity to give a specific pull on the rope at a specific speed. The tractive effort in pounds per ton needed to start the load from rest is an important point when calculating the pull on a capstan rope for hauling a specific load. This varies according to the nature of the track, diameter of the truck wheels, &c., as the co-efficient of friction for a truck hauled on steel rails (usually about 40 lb. per ton of load) is considerably less than for a truck hauled on a macadam road. When the load has to be hauled up a gradient, due allowance should be made for the gravity pull. These factors are of importance as they materially affect the size of the capstan necessary for various kinds of work. A type of electric capstan which is claimed to conform to the above requirements is made by Thomas Broadbent & Sons, Ltd., of Huddersfield, who specialise in the manufacture of hauling and hoisting machinery. In the type manufactured by this firm the attendant has merely to press a foot pedal to bring the capstan into immediate operation. It is brought to rest by an automatic electric brake, which operates when the pedal is released.

Ball Bearing Equipped Handling Appliances

By a Mechanical Engineer

In recent years attention has been focussed with increasing intensity on the many problems relating to the handling and transportation of all kinds of materials. In place of the old haphazard methods there is now systematic arrangement coupled with appliances designed to meet particular needs. Crude vehicles and mechanisms are being supplanted by those of modern design constructed to give both long and efficient service. An outstanding feature in the past has been the simple and at the same time inefficient bearings used, but these are rapidly giving place to the ubiquitous ball bearing. Even the humble wheelbarrow has not been neglected. As an example of this the following is a typical case.

A director of a large firm in Staffordshire informed the writer that for a long time there had been continual trouble with the workmen on account of the difficulty in moving the loaded barrows. As an experiment a double row ball bearing of a well-known make was fitted. The success of the experiment was quickly apparent, as keen competition between the men for the ball-bearing barrows resulted. Eventually all the barrows were so fitted and an old grievance entirely removed.

Speaking generally, the whole matter resolves itself into the question of ultimate cost to the user. Initial expenditure is, of course, important, but it is much more economical to make use of a machine or device which in, say, five years has cost a less amount to operate and at the same time is giving greater production, than to make use of an inefficient machine requiring continual attention. The plain bearing depends entirely for its efficient operation on two circumstances, viz.,

(*a*) The formation of a proper oil film.
(*b*) Continual attention to ensure that conditions are kept such that the oil film is retained.

In all kinds of handling appliances, including cranes, aerial ropeways, underground haulage ways, &c., the inaccessibility of the bearings is conspicuous. To preserve space bearings are frequently crammed into some out-of-the-way corner, and as a result they are eventually forgotten. Guide pulleys, crane hooks, and other parts are very often entirely out of reach so that the continual use of a squad of men for the sole purpose of oiling and keeping such bearings in order is necessary. It is just in such cases where, on account of the very nature of things, the plain bearing is undesirable that the efficient and reliable ball bearing serves admirably. The fact that a ball bearing properly housed and packed with grease will often run from six months to a year without any attention whatever is sufficient argument in itself to warrant its extended use.

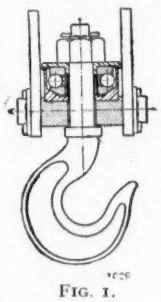


FIG. 1.

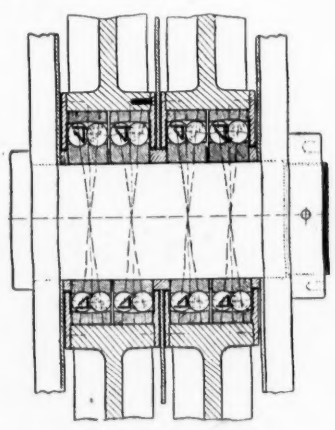


FIG. 2.

Interesting examples are shown in the illustrations. Fig. 1 is a typical mounting for a crane hook. Fig. 2 shows a mounting for a pulley block dealing with a load of about 55 tons and fitted to a floating crane. Fig. 3 illustrates the method of applying ball bearings to a rope wheel which must be free

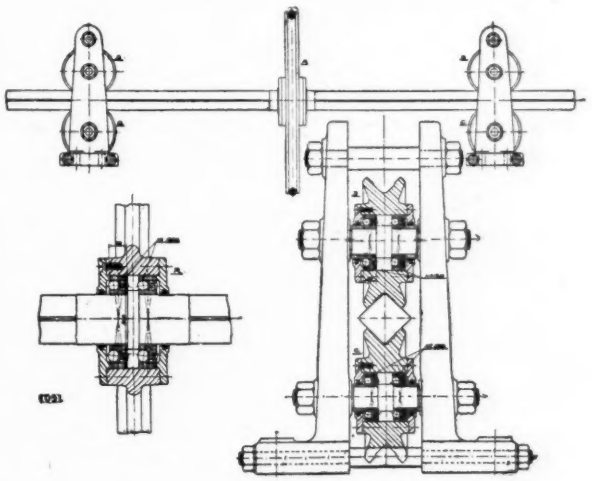


FIG. 3.

to move laterally. This design is suitable for several classes of elevating machinery.

The load on the rope wheels of cable ways, travelling cranes, swing jib cranes, gantry cranes, and other similar structures is, as a rule, very heavy and the power required for the horizontal

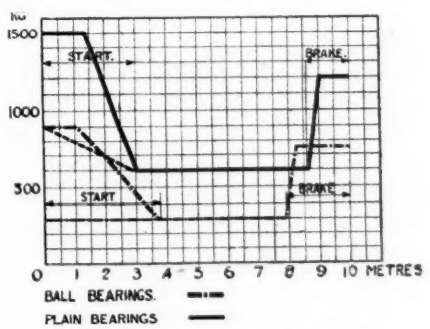


FIG. 4. POWER DIAGRAM.

motion is principally exerted in overcoming the frictional resistance at the circumference of the travelling wheels and their axle bearings. By substituting ball bearings in place of plain bushes for these shafts, not only is a considerable amount of power saved, but in addition the cables themselves on account of the reduced chafing between cable and pulley grooves last very much longer, which is, of course, a considerable item particularly in the case of aerial ropeways and underground haulages.

As an example of the economy in power alone, a number of important experiments were carried out, and Fig. 4 gives, in the form of a chart, the comparative values of the power required at starting, during acceleration, constant speed and retardation. Summarising the results obtained, it was found that

(1) The frictional resistance of the crane moving horizontally and at uniform speed was reduced to only half the amount by the adoption of double row ball bearings in place of ordinary Babbitt bearings.

(2) With plain bearings the maximum stresses when starting the machinery were 67 per cent. greater than with self-aligning ball bearings.

(3) On an average 50 per cent. more power was required with plain bearings compared with ball bearing equipped cranes.

It is to be particularly noted that it is this average power factor which determines the normal power of the electric motor selected. In consequence it appears that the motor required for plain bearing machinery must develop 50 per cent. more power than that required for machinery fitted with ball bearings.

The writer is conscious of only having touched on this most important subject and a great deal could be said of an interesting and practical character regarding any section of transport engineering. The above remarks, however, are based on full examination of the case both for and against ball bearings. There is not the slightest doubt but that in the not far distant future machines fitted throughout with ball bearings, or with roller bearings in the case of heavy duty units, will be the only kind that progressive engineers will accept.

S. K. F.

Economical Crushing and Grinding

By a Works Engineer

ONE of the most important problems in many of the chemical works of this country is the question of the economical crushing and grinding of the raw material to reduce it into a condition or size necessary for preparation for subsequent processes. The question is a particularly large one as such a large variety of materials have to be treated, some of these materials being very tough and difficult to break, whereas other materials are very friable, and, therefore, easily ground; again, some materials have to be roughly crushed whereas others have to be reduced to a very fine powder, and it will at once be seen that practically each grinding proposition has to be dealt with by itself.

We give briefly an outline of the various grinding and crushing machines, most of which are used for special purposes:

Jaw Crusher

This machine is designed and constructed for crushing hard rock, limestone, ores and other brittle material. The mouth of the machine into which the material is fed consists of a fixed and movable jaw, the surface of these usually being serrated. The movable jaw is set at an angle to the fixed jaw, and by means of an eccentric on the driving shaft, the moving plate has a backward and forward motion which is larger at the top than at the bottom. This action jams the material against the front plate, crushing it until fine enough to pass the opening at the lower end. The machine is constructed so that the size of the finished sample can be varied as required.

Toothed Revolving Crusher

This machine is constructed with one or two sets of rolls placed above each other, and is used for crushing bones, horns, hoofs, and many other materials. When the material being crushed is of a tough nature it is usual for the two rolls to run at a different speed so as to give a tearing as well as a crushing action. When bones are being crushed for degreasing purposes it is usual to pass them through a machine with one set of rolls, but when a finer sample is required the machine is supplied with a second set of rolls made with finer teeth and run at a higher speed, which reduces the material which has been passed through the coarse crushing rolls above them. For softer materials where it is necessary to produce as little dust as possible the rolls should run at equal speeds.

General Grinding

For general grinding, that is to say, where a machine is required for reducing a large variety of materials to various degrees of fineness, varying from a powder which will pass a sieve with eighty holes to the lineal inch to a coarse sample to pass $\frac{1}{8}$ in. mesh. The disintegrator, made by Christy & Norris, Ltd., of Chelmsford, is very extensively used in chemical works. This machine is made in six sizes, so that it is suitable for firms which are doing a small amount of grinding or firms which have a very large output.

The advantages which these machines possess for the average chemical works is that they will grind a very large range of materials varying from such soft material as magnesia to a tough tenacious material as indiarubber. Amongst the materials which are being regularly ground by them are alum, sulphate of ammonia, charcoal, antimony, quinine bark, barytes, bauxite, borax, caustic soda, copper sulphate, cream of tartar, French chalk, gelatine, glue, gum, gypsum, lime, phosphates, salt, dried seaweed, soap powder, soda, and the various kinds of roots, barks, leaves, and crystals. We mention this rather long list to show the large range of work the machine does. Another point in its favour is that a fine or coarse sample can be produced as required.

In Fig. 2 is reproduced a section of the machine showing its simplicity. The material is fed into the machine through the opening in the casting from which it falls into the grinding chamber. The disc in which are fitted the beaters runs at a high rate of speed and the beaters, on coming into contact with the material, pulverise it, and as soon as it is sufficiently fine, it passes through the screens, these screens being made in various sizes, the openings varying from $\frac{1}{80}$ in. up to 2 in. As the whole of the grinding is done by percussion, you will thus see that the wear and tear is reduced to a minimum and all the power absorbed goes into the work.

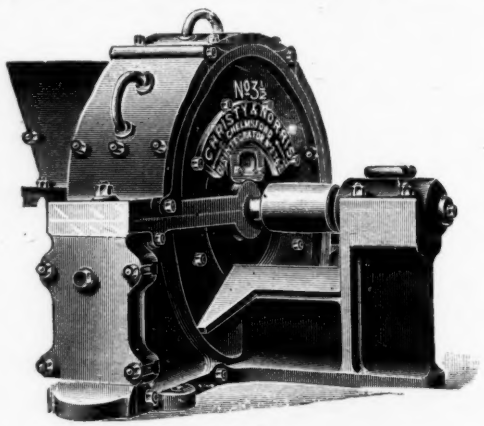


FIG. 1.

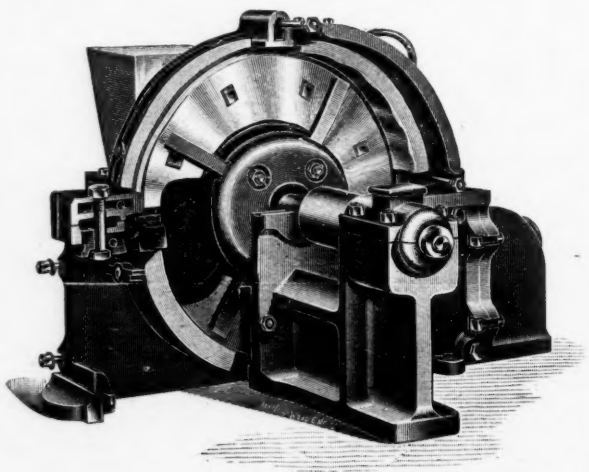


FIG. 2.

In Fig. 3 is shown a complete grinding, elevating, and sifting plant which is self-contained. The hopper of any given size can be fitted to the automatic worm feed of the disintegrator, and when the machine is then started up the

material has not to be touched until it is of the required fineness, when it is delivered into the bags and is ready for taking away.

The working of the machine is as follows : The worm feed

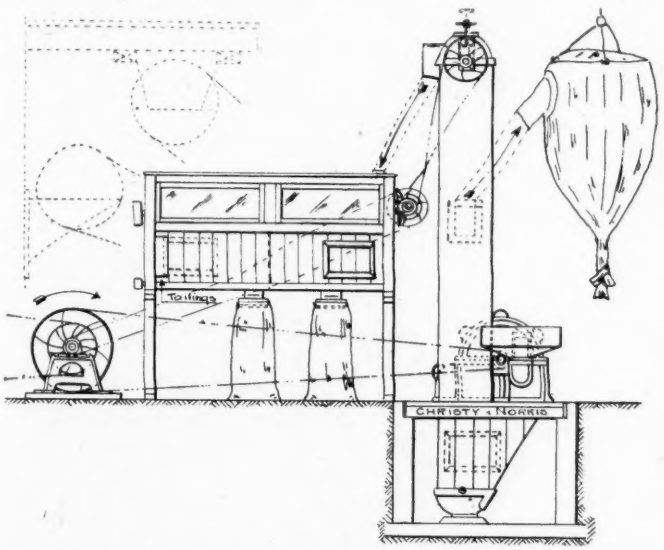


FIG. 3.

collects the material to be ground from bulk and delivers it into the disintegrator, which grinds it, and after passing through the screens, the material falls down the pit stand into the elevator boot, the elevator is fitted with a chain carrying cups, which is an endless band. These cups collect the ground material amd lift it up and shoot it into the dressing machine. The dressing machine is covered with one or more samples of mesh according to the different grades required, and the material is then separated in this machine into the different grades and delivered into bags or boxes. Any coarse material remaining, which will not pass the sieves, is automatically returned to the disintegrator for further reduction.

Ball or Tube Mill.

These are used where a very fine or impalpable powder is required. The Ball mill consists of a cylinder charged with balls into which the material which has to be reduced is placed. The machine is then closed and run for a given period, which varies with the nature of the material being ground, when the whole of the material is extracted. In the Tube mill, which consists of a long cylinder filled with balls, the material is fed into it in a stream at one end gradually working its way through and being discharged at the other, by which time it is very finely pulverised. Some of these machines are fitted with a fan which sucks out the very fine dust as it is produced—where it is blown into a settling chamber.

In many cases the material after being ground in the disintegrator does not require any further treatment, in which case we advise a plant as per illustration No. 4, which consists of the disintegrator, feed, and a square box. The material when ground passes through the disintegrator into the box, and when the box becomes full the disintegrator is stopped and the box emptied by hand.

If continuous work is required, an elevator can be attached to the box, so that the ground material is lifted and delivered automatically into bags, thus serving the stopping and starting of the plant.

Edge Runner

This machine consists of a flat circular bed on which revolve two heavy runners. The material to be ground is fed into the pan in which the bed is fixed, and by means of a crusher or plough is kept in the path of the runners. These have a rolling, and, at the same time, a rubbing action which breaks up the material reducing it to various degrees of fineness. They are used for a large range of works, sometimes for coarse crushing and sometimes for fine crushing. They are very largely used for crushing seeds for the extraction of the oil, as their action breaks up the oil cells. They are also used for mixing purposes, such as ingredients which are used for the making of dry soap powders, various ointments, &c., and are often used to work in conjunction with the disintegrator.

Magnetic Separator

As many materials which have to be ground often contain a certain amount of iron it is advisable to have working in connexion with the grinding plant a magnetic separator for extracting the iron before the material is fed to the grinding or crushing machines. The machine most generally in use is the one shown in Fig. 4, which consists of a revolving barrel made up of a number of electro magnets, the poles of the magnets being arranged to project beyond the cylindrical surface of this drum. The magnets are magnetised over a certain fixed arc and demagnetised over the rest of the periphery of the drum. Fig. 4 shows this machine in perspective; the material passes over the studded roller, and any iron or steel collected is conveyed on these magnetised studs under the machine, where it drops off as the studs are demagnetised.

As regards the size of plant to be installed ; this, of course depends entirely on the amount of material to be handled and is best left to guarantees from the makers as to the capacity of their machines for producing the grade required. In any case, it is not a sound policy to continuously exceed the rated capacity of the machine, as, owing to the great stresses put upon the various parts of the machine in practically every case of mechanically disintegrating material, increasing these stresses simply strains the machine and often causes rupture of some essential part, with the consequential stoppage of the plant.

With regard to the fixing and lay-out of the grinding plant. Great care and thought should be given to them as the machine

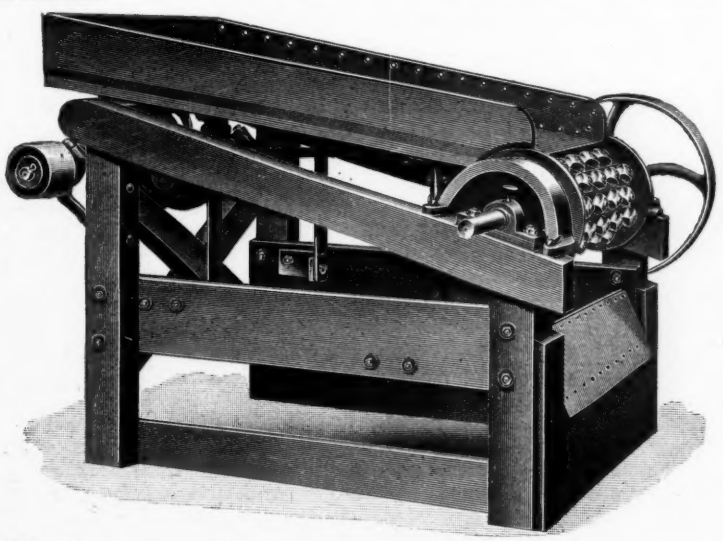


FIG. 4.

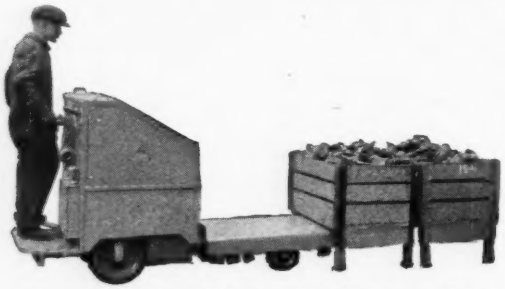
should be fixed so that all parts are easily accessible, as the machines are generally working on rough material and in a dirty atmosphere, consequently the bearings require more attention than machines which are working under cleaner conditions, as this will often prevent stoppages or breakdowns.

An American Visitor

MR. GEORGE M. NORMAN, chemical director of the Hercules Powder Co., Wilmington, Delaware, U.S.A., has arrived in this country and is at present staying at the Savoy Hotel, London.

Petrol-driven Industrial Trucks

THE use of small self-propelled trucks for transport purposes in and around industrial plants has made great headway during the past few years. For work of this kind the best kind of truck is, undoubtedly, a self-contained unit, which will give the utmost flexibility in use, and be always ready for service. A novel truck which is claimed to meet the above requirements is the Clark " Truclift," a self-contained petrol-driven machine, which is being supplied by the



THE " TRUCLIFT " PETROL-DRIVEN TRUCK IN USE.

machinery department of Millars' Timber and Trading Co., Ltd., Pinners' Hall, Great Winchester Street, E.C.2. The " Truclift " is provided with a lifting platform, enabling the operator to load and unload the machine without dismounting. It is under 3 feet in width, to facilitate its use in a narrow aisle. It is said to be capable of carrying a load of 4,000 lb. up a medium grade on low gear.

Provided with four wheels, it has a riveted channel frame and is fitted with a 4-cylinder petrol engine, with enclosed valves, high tension magneto ignition, impulse starter, fixed spark, thermo-syphon cooling and oil-circulating pump. The engine drives a two-speed gear of the planetary type, and a pressure pump (for operating the lifting platform) by means of a roller chain. From the gear the drive is through a reverse-box and propeller shaft to the front or driving axle, the latter being bevel-driven. The overall reduction in high gear is a trifle over 5 to 1 ; and in low gear, 15½ to 1. The maximum speeds of the truck in either direction in high and low gear are six and two miles per hour respectively. The engine-driven pressure pump previously referred to forces light oil into a lift cylinder working under a pressure of 240 lb. per square inch, when lifting a load of 4,000 lb. on the platform. The lift cylinder has a stroke of six inches, and it operates a series of lifting levers through a rack and gear segment. This lift gear will, it is claimed, operate the 4,000 lb. load from the minimum height of 11 inches above the floor to the maximum height of 16 inches in eight seconds. The lift can be stopped at any point by the control lever. The truck brake is operated by a foot pedal on the running board, the brake being applied automatically when the driver removes his weight from the pedal.

Current Collecting Devices

THE efficiency of electric locomotives running on rough contractors' railways at tips or dumps is frequently impaired by the difficulty of current collection owing to the very rough nature of the tracks and the consequent de-wiring of the bow or trolley wheel. A special collector which is claimed to overcome the difficulty has now been designed by Brecknell, Munro, & Rogers, Ltd., of Thrissell Street, Bristol, who specialise in the manufacture of electric current collecting devices for all purposes.

They also manufacture a cable drum which is used on wharf-side travelling cranes, the drum being usually fixed to the crane itself, and the end of the cable fitted into the plug boxes at various points along the wharf wall in a similar manner to that in which walking pipes are connected to hydraulic cranes for a similar purpose. It is, of course, quite impracticable to use overhead wires or to utilise the rails for transmitting current to cranes in such positions. Their centre post collector is made in a wide variety of sizes and can be constructed for any number or size of collecting rings to form a flexible connexion between the revolving and stationary parts of the crane or other apparatus.

A New Spray Development

WE are indebted to Mr. D. M. Newitt, B.Sc. (London), A.I.C., A.R.C.S., of St. Stephen's House, Westminster, for the following note :—

In processes involving the washing of gases, removing suspended particles, as a substitute for steam in catalytic processes, for the evaporation of liquids, and the deodorisation of edible oils, spraying devices are indicated.

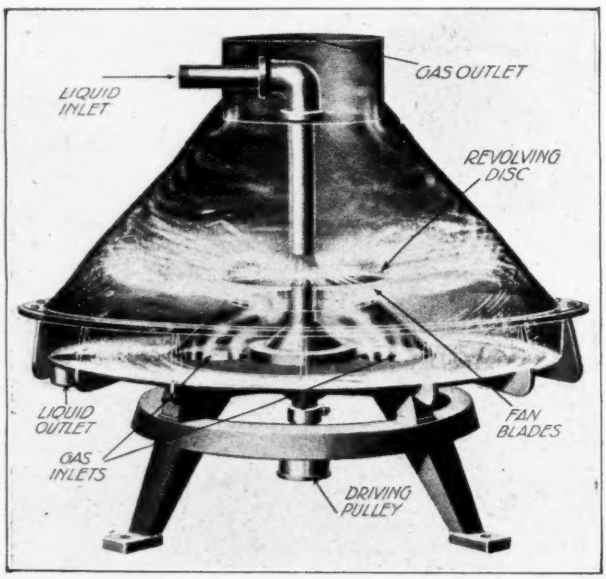
Devices of the type which produce spray by forcing liquid through a small orifice necessitate the use of filtering screens, and with this precaution stoppages are not infrequent, while nozzle wear and corrosion are a source of trouble. Moreover, such are inappropriate for concentrating strong liquors for crystallisation, and on the whole this type of spray is of more limited application than the prospective possibilities of the principle *per se* would appear to warrant.

For evaporating and scrubbing, indeed, for all purposes in which atomisation and intermixture by spray naturally suggests itself, efficiency depends upon breaking up all the liquid into the finest drops, and the establishment of intimate contact with the gas.

These conditions have been met in a device emanating from the United States in which the spray liquid is discharged downwards on to the upper side of a disc spreader revolving 1,800 revs. per. min., to the under side of which is attached a number of fan blades against which the gas to be treated is projected, a cone-shaped inner compartment directing it into the spray disc spreader, at the same time preventing liquids from reaching the gas inlets.

The tangential motion of the disc atomises the liquid, making a curtain of uniform density through which, due to each particle revolving, no resistance is offered to the passage of gas.

A further and complete scrubbing effect is produced by the final projection of both gas and liquid, now closely intermingled, against the ribbed conical walls constituting the



PHANTOM VIEW OF CECO SPRAY IN OPERATION.

enclosing medium of the device. Owing to their velocity, they are held close to these walls and all entrained liquid is scrubbed out.

Such troublesome problems as the avoidance of encrustation when concentrating liquors for crystallisation, the evaporation of phosphoric acid, with reduction of the fluoride content and the recovery of volatile fluorides, and the deodorising of edible oils are said to have been successfully dealt with.

The illustration in phantom view makes the principle of operation clear.

The British Industries Fair

How to Find the Chemical Exhibits

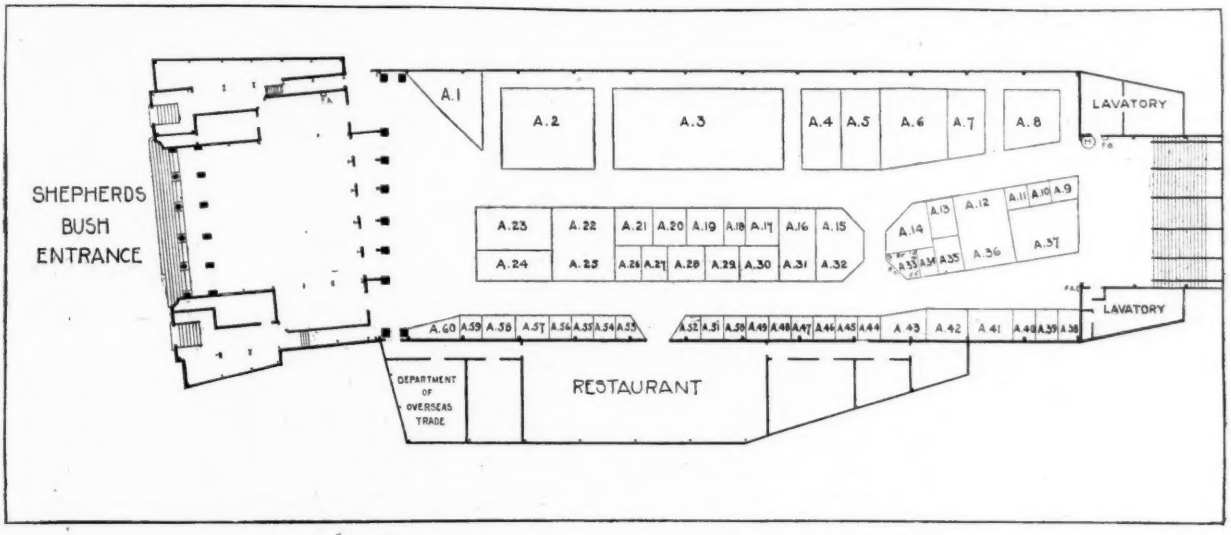
ONE of the most valuable features of the British Industries Fair, which will be held in London and Birmingham from February 27 to March 10, is the particular attention which the organisers are paying to overseas buyers. No fewer than 50,000 invitations have already been sent to buyers overseas, and the Department of Overseas Trade confidently anticipate that a very large proportion of these will be accepted. Some idea of the size of the fair can be obtained from the fact that at the White City alone 200 tons of timber have been used for the construction of the exhibitors' stands. These stands have absorbed 20 tons of paints and distempers, and over 10,000 asbestos panels, each weighing ½ cwt., have been used. The total area of the stand walls amounts to 250,000 sq. ft., the frontage of stands alone being 3½ miles in length. When the stands at Birmingham are added the total distance which a visitor will have to walk to inspect the whole fair will be well over 5 miles.

As already stated in THE CHEMICAL AGE, the display of chemicals at the White City is thoroughly representative of all kinds of chemical and allied products. Access to the chemical section is greatly facilitated by the centralisation of kindred products and by its situation immediately inside the Shepherd's Bush entrance.

In order that visitors to the chemical section may be able to locate any stand or stands in which they are particularly interested we reproduce on this page a numbered plan of the stands in this section. By consulting the key which follows the visitor will readily locate the exhibits he is looking for without putting himself to the trouble of wandering round until he finds them :

SECTION A. STAND NO. 1, South Metropolitan Gas Co. ; 2, United Alkali Co., Ltd. ; 3, British Dyestuffs Corporation, Ltd. ; 4, British Alizarine Co., Ltd. ; 5, Ajax Aniline Dye Manufacturing Co., Ltd. ; 6, Boots Pure Drug Co., Ltd. ; 7, W. J. Bush & Co., Ltd. ; 8, Burroughs Wellcome & Co. ; 9, Evans Sons Lescher & Webb, Ltd. ; 10, Pierson, Morrell, & Co., Ltd. ; 11, J. F. Macfarlan & Co ; 12, British Drug Houses, Ltd. ; 13, Thomas Morson & Sons, Ltd. ; 14, Howards & Sons, Ltd. ; 15, Scottish Dyes, Ltd. ; 16, L. B. Holliday & Co., Ltd. ; 17, J. W. Leitch & Co., Ltd. ; 18, Williams Brothers & Co. ; 19, Graesser-Monsanto Chemical Works, Ltd. ; 20, Wilson Brothers Bobbin Co., Ltd. ; 21, B. Laporte, Ltd. ; 22, Orr's Zinc White, Ltd. ; 23, Gas Light & Coke Co. ; 24, Midland Tar Distillers ; 25, Orr's Zinc White, Ltd. ; 26, Bowdler & Bickerdike ; 27, British Cyanides Co., Ltd. ; 28, Albright & Wilson, Ltd. ; 29, James Robinson & Co., Ltd. ; 30, Hickson & Partners, Ltd. ; 31, L. B. Holliday & Co., Ltd. ; 32, Scottish Dyes, Ltd. ; 33, Association of British Chemical Manufacturers ; 34, J. L. Rose ; 35, May & Baker, Ltd. ; 36, British Drug Houses, Ltd. ; 37, Stafford Allen & Sons, Ltd. ; 38, Elel, Ltd. ; 39, C. R. Harker, Stagg, & Morgan, Ltd. ; 40, General Chemical & Pharmaceutical Co., Ltd. ; 41, Johnson & Sons (Manufacturing Chemists), Ltd. ; 42, Whiffen & Sons, Ltd. ; 43, Thomas Tyrer & Co., Ltd. ; 44, Hopkin & Williams, Ltd. ; 45, Frederick Allen & Sons (Poplar), Ltd. ; 46, J. B. & W. R. Sharp, Ltd. ; 47, Southdown Chemical Co., Ltd. ; 48, Alliance Colour & Chemical Co., Ltd. ; 49, J. C. Oxley's Dyes & Chemicals, Ltd. ; 50, North British Chemical Co. (England), Ltd. ; 51, Grays Dyes & Colours, Ltd. ; 52, A. Boake Roberts & Co., Ltd. ; 53, J. M. Collett & Co., Ltd. ; 54, J. B. Wilkinson ; 55, J. H. Dennis & Co., Ltd. ; 56, Marley Hill Chemical Co., Ltd. ; 57, Burt, Boulton, & Haywood, Ltd. ; 58, Keeling's Oxides, Ltd. ; 59, St. Helens Smelting Co., Ltd. ; 60, Acme Chemical Co., Ltd.

Other exhibits of interest to the chemical industry will be found in the Scientific and Optical Section and in the Glass Section, while mining and quarrying plant, weighing and measuring appliances and instruments, paints, colours and varnishes, &c., will be found at Birmingham.



PLAN OF EXHIBITS IN THE CHEMICAL HALL, SHEPHERD'S BUSH, LONDON.

Work of the Government Chemist

DEALING with the Department of the Government Chemist, Sir Eric Geddes's Committee on National Expenditure state that the provisional estimate has been reduced to £50,076, thus effecting a saving of £520. The report further states that the Government Chemist advises Government Departments, Committees, and Parliament on all questions requiring the advice of expert chemists, with the exception of such work as is performed by the "Fighting Departments." The work does not admit of a merely "quantitative" comparison of the number of "samples" analysed in different years. It does, however, appear that the number of samples dealt with steadily maintains the pre-war average of about 350,000 a year, but the field covered by these analyses is more varied than previously and much "fundamental" work is thereby involved.

Unsuccessful Claim against Davis Brothers

AT the Nottingham County Court on February 15, Dr. Tinsley Lindley gave judgment in the case, reported in THE CHEMICAL AGE last week, in which the Basford Chemical Co., Ltd., Vernon Road, Old Basford, claimed £100 damages from Davis Brothers, Barton House, Deansgate, Manchester, for alleged negligence in failing to carry out their professional plan and scheme in connexion with certain plant at the Basford works. Dr. Lindley held that there were no defects so far as the plant was concerned, and that the reason it did not work properly was because it was not erected on a suitable basis. He therefore dismissed the claim and gave judgment on the counter-claim for £75. The counter-claim was for goods supplied and services rendered as consulting chemical engineers.

Resumed Cream of Tartar Inquiry

Evidence on Behalf of British Makers

THE inquiry before the Referee (Mr. Cyril Atkinson, K.C.) into the application for the removal of cream of tartar, tartaric acid, and citric acid from the list of taxable goods issued by the Board of Trade was resumed on Thursday, February 16, continued on Friday and Saturday, and adjourned to to-day (February 25).

MR. C. A. HILL, managing director of British Drug Houses, Ltd., continuing his evidence, dealt with what he had seen during the course of a visit to the works of Kemball, Bishop & Co., one of the opponents, and manufacturers exclusively of the three substances in question. He expressed the view that the processes were such as to bring the substances within the limits of fine chemical manufacture. As to the process described by the French witnesses, he did not regard it as commercially practicable.

MR. JAMES SWINBURNE, F.R.S., said that the processes he had seen at the works of Kemball, Bishop & Co. were certainly, in his opinion, fine chemical processes, and involved a great deal of skilled supervision. There were about twenty chemists at the two factories who, he understood, were engaged in carrying out the manufacture. One factory was making cream of tartar, and the other tartaric acid and citric acid. In such cases real chemists must be employed, even though they did not use all their chemical skill. He agreed that in substance the process used by Kemball, Bishop & Co. was one of solution, crystallisation and decolorisation, but there was also involved the precipitation of calcium sulphate, which needed skilled supervision.

MR. J. R. LANKSHEAR, at one time lecturer in chemistry at the Victoria University, and manager of a Government factory during the war, said he had had a long experience of chemical manufacturing operations as a works manager. In 1917 he formed the firm of Lankshear, Wicksteed & Co., Ltd., manufacturing chemists, Mr. Wicksteed being late chief engineer to Kemball, Bishop & Co. At present his firm was manufacturing only tartaric acid. When he first contemplated taking up this manufacture his view, from a study of the text books and other literature, was that it was an extremely simple process, but in practice he had not found it an easy substance to manufacture. He described the processes in great detail, showing the constant chemical attention and skill required. In his own works, where at present only tartaric acid was being made, there was a chemist always on duty during the twenty-four hours for 365 days in the year. The works were never left without a chemist in executive control who could give definite instructions to the workmen. There was a chief chemist and five assistants, and forty-five people who had not had special chemical training. The chemical assistants were men of about twenty-five years of age who had had chemical training and had passed through a period of trial in the works.

THE REFEREE: Would you call them highly skilled chemists?

MR. LANKSHEAR said that raised a difficult question. As a university lecturer he had often found that a man who passed through his course at the University with honours was by no means so good as a man who was less brilliant when it came to works practice. In fact, it often paid them to pay the more brilliant man to keep away from the works.

In cross-examination he said the present distinction between "fine" and "heavy" had been forced upon him by these proceedings. In 1916 the distinction was not regarded as of such importance as now, but it was his decided opinion to-day that all three substances were fine chemicals, and he had arrived at that decision from his experience in the manufacture of tartaric acid. He did not pose as an expert in cream of tartar, but, in his opinion, cream of tartar of B.P. purity was a fine chemical. If, on the other hand, it was not of that purity and had been made on some such process as that mentioned by the French witnesses, then he should not class it as a fine chemical.

SIR ARTHUR COLEFAX: Then cream of tartar as it comes on the London market is not necessarily a fine chemical?

MR. LANKSHEAR said he should have grave doubts about every individual parcel on that point.

THE REFEREE: You say that if it complies with the B.P. standard it can fairly be called a fine chemical?

MR. LANKSHEAR said that was so, but if it had a commercial use with something which did not comply with this test he did not know enough about it to say.

THE REFEREE: Do you really affirm that the manufacture of these three substances could not be carried on with a skilled chemist giving a broad supervision, apart from analysis, and that it really needs this expert supervision in the various stages of the process?

MR. LANKSHEAR: I can affirm that from my own experience.

MR. A. M. PEAKE said that in 1902, after being with Ogston & Moore, analytical chemists, for a short time, he went to the Mante works at Marseilles as chief laboratory and control chemist, and remained there for over two years. At that time all three substances were made, and he was in charge under M. Gladytz's father, who was a skilled chemist, but difficulties in manufacture were brought to him in the laboratory to be solved. Whilst he was with the firm he became acquainted with the general methods of manufacture of the cream of tartar and citric acid in the small works at Marseilles, where he worked. He described his experiences in detail, and stated that the staff consisted of three chemists (including himself) and two men who, according to English standards, might be called chemists but were not regarded as such in France because they had not obtained a diploma. At present he was with the Phœnix Chemical Co. and was familiar with their processes for the manufacture of tartaric acid and citric acid. His opinion was that it would be impossible to carry out the process at the Mante works without skilled chemical supervision.

MR. H. BALLANTYNE, as in previous cases, gave his definition of a fine chemical. He had been over Kemball, Bishop & Co.'s works, and had no doubt that the process involved skilled chemical supervision, there being eight chemists in the cream of tartar works.

MR. J. E. WHITEHALL (one of the three managing directors of Kemball, Bishop & Co., which firm also controlled J. B. Lawes & Co.) gave figures with regard to the number of skilled chemists employed by the two firms. The two firms had 412 employees, which included ten professional chemists and five apprentices. There were also sixteen men specially skilled in the process. The proportion of the salaries of the skilled workers to that of the process workers was 45, taking the three substances in question. The proportions in which tartaric acid was sold were 61 per cent. to wholesale druggists and saline manufacturers; 22 per cent. to baking-powder manufacturers; 4 per cent. to confectioners; 2 per cent. for export; and the remainder to various customers. Replying to the Referee, the witness said that foreign competition was very keen.

DR. W. R. ORMANDY said that fine chemicals were not to be put into a compartment by themselves, and in determining what was a fine chemical it was necessary to take into consideration the skill required for control, the size of the batches, the nature of the plant, the value of the product and the ratio of the skilled or unskilled wages involved, the use of the term, whether limited or general, and purity. The use of the product was a leading characteristic, but not an important one. With regard to purity, there was very great difficulty, in the manufacture of all three substances concerned, in getting rid of the colloidal impurities in wine lees or argol, and they produced extraordinary results. The definition of a fine or heavy chemical never occurred to him prior to the passing of the Act. In the case of well-recognised heavy chemicals, he would not take them out of the class of heavy chemicals, even if they fell within his definition, but he could not conceive of a definition of a heavy chemical which was so clear that it did not leave a number of bodies on the border line.

Bronze and Aluminium Powders Inquiry

ON Tuesday an inquiry was opened, under Part II. of the Safeguarding of Industries Act, when Metal Powders, Ltd., and other firms, asked for the imposition of an import duty on gold (brass) metal powders and aluminium powder, manufactured in Germany. The case for the applicants was concluded and the hearing was adjourned until March 14.

Dyeing: Ancient and Modern

Paper by Professor Perkin

LECTURING on February 16 at the Royal Institution on "Dyeing: Ancient and Modern," Professor Arthur Perkin said that until comparatively recent years the art of dyeing owed very little to conscious science, and indeed many important methods of dye application which were extremely ancient were in use at the present time. There was reason to suppose that the art of dyeing originated in the East, and it was likely that the first dyestuff to be discovered was indigo. There could be little doubt also that dyeing in general must have been preceded by the mere processes of staining which were still in vogue. When we considered that Nature had provided us with few dyes of real value which were substantive, progress in obtaining dyeing results of anything like a permanent character must have been slow. If indigo were excepted, the choice of really substantive natural dyes was somewhat limited. Among the early dye processes, in the discovery of which special ingenuity must have been displayed, were those by which a dyestuff insoluble in water was applied to a fibre. The processes, as a rule, consisted in steeping the material in a warm solution of an alkaline extract of the dyestuff, the alkali salt of the dye being found in such cases to be attracted by the fibre, giving, however, only a dull tint, but on subsequently acidifying the dyed material with an organic acid in the form of plant juice the dye salt was decomposed with liberation of the free colouring matter. In that way a fine but fugitive red could be obtained from safflower, an Eastern plant. The process was employed at least 2500 B.C. A good orange could in a similar way be obtained from annatto, which was not, however, used at the present time for dyeing fabrics. Annatto and safflower were applied to fabrics by such processes in this country fifty years ago, and were still in use in the East at the present time.

The Oldest Dyestuff

The oldest dyestuff on record was kermes, which was mentioned in the Book of Exodus under the Hebrew name of Tola or Tolaschami. Its discovery was made without doubt at a far earlier period than the time of Moses and had been attributed to the Phœnicians in Palestine. Kermes was an insect, and was useless as a dyestuff without the aid of a mordant. With an aluminium mordant it gave a crimson or scarlet colour, and there could be little doubt that the word "scarlet" in the Scriptures had reference to the red shade given by the kermes. Until the comparatively recent discovery of cochineal, an insect of the same class but much richer in colouring matter, kermes was a most important dyestuff, and was still employed until well in the last century. The Indians, in place of kermes, employed an allied insect, the coccus lacca, the source of lac dye, which also gave on an aluminium mordant a scarlet colour. Perhaps the most remarkable discovery in dyeing which occurred at a very early date was the dyeing of cotton with the aluminium mordant of the first red colour, now known as Turkey red.

Indigo: 3500 B.C.

In several cases with vegetable compounds the natural colouring matters were not contained in the plant in a free state, but as glucosides. Such was the case with madder, the alizarine being there as a glucoside named ruberythic acid. Again, both glucoside and enzyme occurred in Persian berries, a dye still used for the production of yellow effects in calico printing. Rhamnetin was present in colouring matter in the form of glucoside, and if one dyed with Persian berries, gradually raising the temperature about 40°, the enzyme present hydrolysed the glucoside with the formation of rhamnetin which dyed the material. Although madder, about the middle of last century, was considered to be the most important colouring matter known, natural indigo easily took a second place owing to the very permanent character of the dye which it yielded. A garment dyed with indigo had been found in Thebes, and was said to date back to 3500 B.C., and there could be little doubt that the blue mentioned in Genesis referred to material dyed with indigo. No dye perhaps was held in more esteem in ancient times than that which was now known as the purple of the ancients, which was mentioned in the Book of Exodus, and also in the Book of Deuteronomy. This dye was of extreme antiquity. Being largely dyed at Tyre, the Manchester of the ancients, it was also known as Tyrian Purple. It was obtained from certain sea snails of the genus Purpura or Murex, which possessed near their head a cyst or vein containing a small amount of pus-like liquid. Fabrics impregnated with a solution of the liquid developed on keeping a fast purple colour. The amount of colouring matter present in the Purpura was very small, and the expense of the dyeing operation must have been very great; it was recorded that at one time a pound of wool dyed in this manner could be sold for what was now equivalent to £36 sterling.

Society of Glass Technology

The Jubilee Meeting

THE fiftieth meeting of the Society of Glass Technology was held at the Manchester College of Technology on Wednesday, February 15, Dr. M. W. Travers, F.R.S., presiding.

In opening the proceedings, the chairman said that from very small beginnings the society had now extended its sphere of operations so as to include a considerable number of members in America, France, Belgium and Asia. He was not aware of any society of the same size which had such far-reaching influence. Due acknowledgment ought to be paid to such early pioneers in the development of the organisation as Professor Turner, Professor Wood and Mr. Jacobson. He hoped that on the occasion of their one hundredth meeting the society would find itself occupying an even higher functional position than it did at the present moment.

A paper, "The Relative Advantages and Disadvantages of Common Glass Batches containing Soda-Ash and Salt Cake, Part II," by F. W. Hodkin, B.Sc., A.I.C., and Professor W. E. S. Turner, D.Sc., was read by Professor Turner.

The authors stated, in continuation of a paper read twelve months previously, that, in practice, certain glass manufacturers, particularly of tank-made glass, had used different forms not only of alkaline material but also of the lime which constituted soda-lime glasses. Thus, in regard to the alkali, it might be supplied as in the form of soda ash or of salt cake, or, in some cases, of a certain mixture of the two. In the case of the lime, it might be as burnt lime or as slaked lime, or as calcium carbonate, which might be limestone or spar, according to the chalk, or some similar form, which, after all, was the best practice under differing conditions. The results of a number of small-scale experiments were presented on the reading of the previous paper. The particular type of glass dealt with was that in which the amount of calcium oxide was approximately that which was used on the automatic machines which were coming into extensive use; *i.e.*, the amount of calcium oxide in the finished glass was round about 8 per cent.

Batches were tested which approached the quality, though they did not contain quite so much lime, of window glass, and also glasses which contained the constituents in the proportion of, approximately, in the finished glass, 75 per cent. of silica, sodium oxide 12.9 per cent., and calcium oxide 12 per cent. The lime content of window glass might run about 14 per cent. and the silica was usually about 73 to 74 per cent. A distinctly harder glass was obtained, and for test purposes a series of meltings was made, first of all, with batches containing amounts of silica and alkali which would give the oxide and lime contents mentioned. In another set, the batches used contained distinctly less silica, the reduction being 10 per cent. Again, tests were made in which magnesia was added to the batch. Although the tests were made on a small scale they were made repeatedly, and agreement seemed complete right throughout the series.

The melting down of glass was dependent upon a number of conditions, *i.e.*, upon the form of alkali used, the form of lime used, and the relative amounts of lime and soda used. In the case of glasses made for common bottles used on automatic machines the soda-ash burnt lime appeared to be the most readily melted, while the salt cake-burnt lime appeared to be perhaps the slowest. When, however, one dealt with a lime-containing glass approaching window glass quality, or, at any rate, with an additional 4 per cent. more lime, the form in which the glass melted down first was not the burnt lime but the slaked lime, and that, generally speaking, was the form of alkali employed, whereas usually the burnt lime was the slowest. The further point was brought out that with lime-containing glasses the melting could be assisted very considerably by the addition of very small quantities of other oxides, particularly magnesia.

A paper entitled "The Density of Soda Magnesia Glasses and the Calculation of Density in General," by S. English, M.Sc., A.I.C., and Professor W. E. S. Turner, D.Sc., was taken as read.

British Chemical Standard Steel "U"

THE latest sample which is now ready for issue comprises a high carbon steel having a little nickel in it as an impurity. It is of special use as (1) a standard for carbon by combustion or colour; (2) a low manganese standard associated with high carbon; (3) a low nickel standard.

The analyses have been undertaken as usual by a number of experienced chemists in the United Kingdom, France and U.S.A., representing the following interests: British Government Department; United States Bureau of Standards; Referee Analysts, representing users issuing specifications; Works Analysts, representing makers and users.

The standard figures are as follow:

Carbon Steel "U"

		Per cent.	Per cent.
CARBON (combustion)			1.203
,, (colorimetric)	approx.	1.18	
Silicon	,,	0.18	
Sulphur evolved as sulphide	,,	0.043	
Phosphorus	,,	0.055	
MANGANESE			0.472
Copper	approx.	0.05	
NICKEL			0.608
Chromium	approx.	0.03	
Vanadium		trace	

The standard turnings may be obtained in 500, 100 or 50 gramme bottles either direct from Organising Headquarters, 3, Wilson Street, Middlesbrough; or through any of the leading laboratory furnishers at a price just sufficient to cover the cost. A certificate giving the names of the analysts co-operating, the types of methods used, and a detailed list of the results will be supplied with each bottle.

This sample completes a series of fourteen steels containing increments of carbon between 0.03 per cent. and 1.20 per cent., also standardised quantities of the following elements: Si, Sp, Mn, As, Ni, Cr, Co, V, W, Ti, and Fe.

German Reparation (Recovery) Act

New Board of Trade Orders

THE German Reparation Recovery (No. 1) Order 1922, issued by the Board of Trade, exempts certain German scientific and other periodicals from the provisions of the German Reparation (Recovery) Act 1921. Any article is exempted "being a publication in the German language which is proved to the satisfaction of the Commissioners of Customs and Excise to be a periodical publication of a German learned society, or other scientific or philosophical periodical publication." The Order is dated February 16.

A further Order, issued on Tuesday, exempts any article in respect of which it is proved to the satisfaction of the Commissioners of Customs and Excise—(*a*) that such article is imported into the United Kingdom for the purpose of there undergoing any process of manufacture and thereafter being re-exported to Germany; (*b*) that such article is consigned from Germany direct to the manufacturer in the United Kingdom by whom the said process is to be carried out; (*c*) that such article does not pass into the ownership of any person in the United Kingdom and that no payment in respect of it is made to Germany; and in respect of which security has been given by the manufacturer to the satisfaction of the said Commissioners that such article will be returned to Germany within a period of one month after the date of the completion of the said process.

Canadian Dye Discovery

A NEW chemical reaction which could be employed for making dyestuffs from coal tar products has, according to the Toronto Correspondent of the *Times*, been discovered by Professor M. C. Boswell in the course of his research work in the chemical laboratory of the University of Toronto. Two new compounds belonging to a new dye group, one a blue and the other a beautiful shade of rose, have been produced and methods devised for their preparation and isolation in a pure state on a manufacturing scale. With several of his advanced students Professor Boswell is now engaged in fixing definitely the chemical constitution of these new compounds and the best conditions for applying them to cotton, wool, and silk. The dyes are reported to be basic and of high tinctorial power, giving beautiful dyes on silk, fast to light and washing. Other applications of the general reaction are also being investigated.

"Fine Chemical"

To the Editor of THE CHEMICAL AGE

SIR,—I have been connected with the drug trade for fifty years, and have always regarded a refined chemical as a fine chemical. For example, commercial sulphate of iron (copperas), more or less impure, is not a fine chemical, but when this substance is recrystallised, and supplied in small crystals suitable for use in photography or pharmacy, the fact of its having undergone a certain amount of purification entitles it to be classed as refined, or for short, "fine." The word "fine" is a lazy way of expressing the fact that a chemical has been refined. My firm (F. H. Faulding & Co., Ltd.) deals in commercial chemicals, refined or "fine" chemicals, and chemically pure chemicals. Santonine, morphia, quinine, &c., are alkaloids; quinine sulphate is a drug. I consider chemicals are salts of minerals, while salts of alkaloids are drugs.—Yours, &c.,

L. R. SCAMMELL.

54, King William Street, Adelaide,
January 16.

The Education of Chemists

AT a meeting of the Liverpool and North-Western Section of the Institute of Chemistry, held in Liverpool on February 9, Mr. W. H. Roberts presiding, Mr. R. C. Moore read a paper on "The Education of Chemists." It was, he thought, a mistake for the student to concentrate too early on chemistry, because he might not then acquire the sound general education which was so necessary. Every chemist should have a good knowledge of mathematics and physics. They were the most important sciences to him. It was a further advantage to have a working knowledge of French and German. There was a wide difference of opinion as to the amount of research work a student should undertake. The lecturer commended its practice as part of the training, and also for the student to obtain some practical experience in public works or laboratories before he became qualified. In this connexion the lecturer mentioned the arrangements made by a large iron and steel works with which he had previously served for receiving a party of about a dozen University students for a period of a month or two during the long vacation. He emphasised the fact that professional education did not cease with the obtaining of recognised qualifications. Great benefits could be derived from keeping up-to-date in professional matters, from the regular reading of one or more technical journals, and from the membership of a professional society like the Institute of Chemists.

Modifications in Scottish Railway Rates

THE Scottish railway companies have decided to modify rates for conveyance to blast furnaces and steel works of coal, coke, and patent fuel, lime in Class B of the general railway classification, for iron and steel-making purposes, and iron and steel in Class B of the general railway classification. The modified rates are: Coal, coke, and patent fuel rates as at January 14, 1920, plus 75 per cent., plus a flat rate addition of 4d. per ton, with a maximum increase of 3s. per ton. Lime in Class B of general railway classification for iron and steel-making purposes, iron and steel in Class B, namely, pig-iron scrap, billets, blooms, ingots, and bars. Rates as at January 14, 1920, plus 75 per cent., plus a flat rate addition of 4d. per ton. The modified rates came into force on February 15.

Admiralty Chemical Laboratories Investigation

IT has been decided by the Admiralty to appoint a committee to discuss the co-ordination of the work of the various chemical laboratories in the Admiralty service, "to consider the scope of the work now carried out, and report whether any, and, if so, what, rearrangements can be made with due regard to the requirements of each department interested in the work to avoid dissipation of energy, overlapping of duties, and unnecessarily different conditions of service." The members of the committee are: Mr. W. J. Evans, C.B.E. (Director of Establishments), chairman. Engr. Vice-Admiral Sir George G. Goodwin, K.C.B., LL.D. (Engineer-in-Chief), Captain Roger R. C. Backhouse, C.B., C.M.G. (Director of Naval Ordnance), Commander Ll. E. H. Llewellyn (Chief Inspector of Naval Ordnance), Mr. F. E. Smith, O.B.E., F.R.S., A.R.C.Sc. (Director of Scientific Research), Mr. W. J. Berry, C.B. (Director of Warship Production), Mr. F. Ward, C.B.E. (Deputy Director of Armament Supply), Mr. J. Lang, of the Civil Establishments Branch, Admiralty (secretary).

Chemical Matters in Parliament

Trade in Palm Kernels

In reply to Mr. Mosley (House of Commons, February 14), Mr. Churchill said that since the war Germany had imported a much smaller quantity of palm kernels than before the war, when that country took the bulk of the British West African crop. This was no doubt partly due to the effect of the differential export duty imposed in British West Africa in 1919, which had led German crushers to turn their attention rather to copra than to palm kernels, but, owing to the greatly diminished purchasing power of Germany, her purchases of copra were far below pre-war level. Prices of palm kernels, as of other oil seeds, were low in this country at present, and one result had been a fall in the price of margarine to practically the pre-war level, thus benefiting the consumer. West African industry had, of course, suffered by the fall in the price of palm kernels as of other produce.

Ocean Island Phosphates

Captain Rankin (House of Commons, February 14) asked the Secretary of State for the Colonies whether the Germans were being, or had been, supplied with phosphates from Ocean Island; if so, on what terms the phosphates were being or had been supplied; in what form was payment made by Germany; and what was the nationality of the ships conveying the phosphates to Germany.

Mr. Churchill said that since the phosphate industry in Ocean Island and Nauru came under the control of the Commissioners appointed under the Nauru Island Agreement several cargoes of phosphate had been shipped from those islands to Germany in British or Japanese vessels. He was informed that these cargoes were sold at the best price obtainable, in accordance with the terms of Art. 11 of the agreement, through agents in London who had arranged and guaranteed payment therefor.

India Office Varnish Contracts

Major Brown (House of Commons, February 14) asked the Secretary of State for India if his attention had been drawn to the fact that the India Office declined to allow varnish manufacturing firms in the North of England to register their names on the list of contractors, and restricted competition to firms close to London only.

Mr. Montagu said he had referred this matter to the High Commissioner for India, who was now directly responsible to the Government of India for the purchase of stores for that Government. He said the fact was not as suggested in the question. There was upwards of fifty firms on the Store Department list for varnishes, including firms at Birmingham, Ripon, Wolverhampton, Liverpool, Hull, Sheffield, and Bristol. In one case a firm in Northumberland had been excluded from the list because of the remoteness of its works, which made it impracticable without undue inconvenience and loss of time to carry out the approved procedure for test and inspection of varnish—matters which were of special importance in connexion with supplies for use in India. No question of undue preference was therefore involved.

Oil in Palestine

Replying to Mr. Malone (House of Commons, February 15), Mr. Churchill said no concessions to bore for oil in Palestine had been granted to any companies or groups since the British occupation. Certain companies and groups, British and foreign, claimed to have acquired concessions of this nature from the Ottoman Government before the war. When the Treaty of Peace with Turkey was ratified such claims would be dealt with in accordance with the terms of Sect. 6 of the Treaty. Permission had been accorded to certain companies to examine the areas over which they claimed to have acquired concessions, with a view to determining whether or not to pursue their claims. It had been made clear that the grant of this permission did not prejudice the question of the validity of the claims concerned, and, further, that no exploitation would be allowed until the political status of Palestine had been regularised.

Death of Mr. Thomas Forward.

The death occurred on Monday at his residence in Plasturton Avenue, Cardiff, of Mr. Thomas Isaac Forward, who for more than twenty years had managed the South Wales branch of Wailes, Dove, Bitumastic, Ltd., Newcastle-on-Tyne. Mr. Forward was forty-three years of age.

Aerial Wire Ropeways

Some Advantages of the Bi-Cable System.

In a paper read before the Liverpool Engineering Society recently, Mr. J. Walwyn White described the two main types of aerial ropeways. In the first and earlier type one rope was employed for the dual purpose of sustaining the load and for transporting it along the line. He considered this type to be very efficient where the line was straight from end to end, the gradients easy, and the individual loads relatively small. In the second and more elaborate type, in which three ropes were used, two fixed ropes stretched from one end of the line or section to the other, one end of the rope being usually anchored down, whilst the other end passed over a balance weight. The loads were suspended by means of carrier wheels, and were moved along the line by the haulage rope. One great advantage enjoyed by the bi-cable system was the ease with which angles, both vertical and horizontal, could be made absolutely automatically, and another was that the carriers, whether loaded or empty, were returned around the return terminal absolutely automatically. Mr. White, in conclusion, said the grippers on modern installations were usually of the automatic gravity type, so that the carriers were not touched by hand from the time they left the loading rail until they arrived back empty and were automatically detached from the hauling rope and run up to the buffer on the loading rail, where they were brought up and stood ready for their next load.

In spite of the simplicity, adaptability and economy of this method of handling of ores, the disposal of refuse, &c., there still remains a very wide field for its application in chemical industry. Although a ropeway should, if possible, be in a direct line from loading to discharging point, it can follow any route on the way to the tipping ground. The latter may be situated at any distance from the works, as natural irregularities can always be overcome. Labour costs are reduced to a minimum, and in this connexion it has been calculated that three men are capable of working a line handling 80 tons of material per hour, which gives an approximate labour cost of 1d. per ton. When lighter lines are used the tonnage cost increases slightly, but in cases where material is carried at the rate of 10 tons per hour the ropeway can be operated by one man.

Such firms as the British Ropeway Engineering Co., Ltd., of 34, Fenchurch Street, London, and R. White & Sons, of Widnes, manufacture aerial ropeways suitable for the handling and disposal of all kinds of material. They have already supplied installations for use in a large number of chemical works, collieries, &c., in this country, and they are prepared to make more widely known, by practical demonstrations, the efficiency and economy of this means of transport.

British Metals Research

Among the most successful of the research associations established during the last few years, with the assistance of the Government, is the British Non-Ferrous Metals Research Association, the second annual report of which has been issued. The Association has obtained the support of over 100 member firms, primarily manufacturers or users of non-ferrous metals in London, Birmingham, Sheffield, Manchester, and Leeds. The Association, which has its headquarters at 71, Temple Row, Birmingham, now reports the progress of a number of important researches, notably on the influence of impurities up to 1 per cent. on copper, the jointing of metals, the polishing of metals, and investigations dealing with nickel-silver, aluminium, and the atmospheric corrosion of non-ferrous metals.

Recent Wills

Mr. John Lipscomb Grossmith, of Bickley, Kent, chairman of J. Grossmith & Son, Ltd., perfumers £84,635

Mr. George Balme Stephenson, of West Leigh, Easby Road, Bradford, oil and soap merchant, a director of Stephenson Brothers, Ltd..... £79,344

Mr. John Boyle, of 123, King Street, Kilmarnock, and of Grange Park, 87, Dundonald Road, Kilmarnock, drysalter £10,787

Colonel Celestin Charles Edward Cassall, V.D., F.I.C., F.C.S., of Oxford Gardens, Kensington, formerly Public Analyst for Kensington, Westminster, Battersea, and Kesteven and Holland (Lincs.) £2,007

From Week to Week

RADIUM-BEARING AREAS in Vancouver are reported to have been discovered by Mr. H. E. Neave.

THE ENGLISH CROWN SPELTER WORKS, Swansea, were restarted on Tuesday, after twenty months' idleness.

At the Institute of Chemistry on Friday, Mr. H. Ballantyne, F.I.C., read a paper on "CHEMISTS AND PATENT LAW."

The wages of GLASS WORKERS in the Charleroi district of Belgium will be reduced by 27 per cent. as from March 1.

MR. A. M. HENSHAW has been appointed a member of the Mining Dangers Research Board in place of the late Mr. Hugh Bramwell.

The annual dinner of the INSTITUTION OF PETROLEUM TECHNOLOGISTS will be held at the Connaught Rooms, London, on March 21.

D. NAGASE & CO., LTD., importers and exporters of chemicals, have removed their London offices to 60, Mark Lane, London, E.C.

The Earl of Denbigh presided on Tuesday at a luncheon following the annual meeting of the BRITISH SUGAR BEET GROWERS' SOCIETY at the Victoria Hotel, London.

A cinematograph film entitled "THE CONQUEST OF OIL," taken at various establishments of the Anglo-American Oil Co., Ltd., was shown privately in London last week.

According to the Banking Section of the Department of Overseas Trade, CAPITAL INCREASES amounting to £73,400 were made by United Kingdom chemical companies during January.

At the Chemical Industry Club, London, on Monday, Mr. A. H. Thomas read a paper on "DECOLORISING CARBONS," in which some new applications for these carbons were referred to.

At a meeting of the Royal Society of Edinburgh on Monday SIR J. A. EWING read a paper on "Models of Ferromagnetic Induction," in which he gave a detailed account of his recent work on magnetism.

The annual meeting of the ASSOCIATION OF TECHNICAL INSTITUTIONS will be held at the Leathersellers' Hall, St. Helen's Place, London, on March 3 and 4. The president-elect is Mr. Walter Runciman.

At a joint meeting on Friday of the Dominions and Colonies and Indian Sections of the Royal Society of Arts, PROFESSOR W. A. BONE read a paper on "Brown Coals and Lignites: their Importance to the Empire."

MR. J. H. FREEMAN, manufacturing chemist, of Icknield Street, Birmingham, has been nominated for the vacancy on the Birmingham City Council for All Saints' ward caused by the death of Mr. T. E. Smith.

Sir William Pope, Sir R. T. Glazebrook, Sir W. H. Bragg, and Sir J. E. Petavel were among those present at the annual dinner of the INSTITUTION OF ELECTRICAL ENGINEERS held at the Hotel Cecil, London, on Tuesday

The Governing Body of the Borough Polytechnic Institute, London, will require, not earlier than September next, the services of a Principal. Particulars may be obtained from Mr. F. R. Heath, the secretary of the Institute.

BRITISH OIL AND CAKE MILLS, LTD., are about to commence the erection of the main buildings of their new oilcake and seed-crushing mill at the James Watt Dock, Greenock. The plans were approved by the Greenock Dean of Guild Court on February 16.

A paper on "THE PHYSICAL PROPERTIES OF MOTOR FUELS," by Dr. W. R. Ormandy and Mr. E. C. Craven, was read on Monday at a meeting of the Scottish Centre of the Institution of Automobile Engineers, held in the Royal Technical College, Glasgow, Mr. J. F. Henderson in the chair.

We regret to record the death, on February 18, at 2, Airedale Cliff, Bramley, Leeds, of MR. JOHN STAMFORTH WALCH, for thirty-six years works manager of Tunstall & Co., Ltd., tar distillers, of Leeds and Newlay. Mr. Walch, who was sixty-five years old, was interred on Wednesday at Horsforth cemetery.

SIR ROBERT BIRD, BART., eldest son of the late Sir Alfred Bird, M.P., has been approved Unionist candidate for the West Division of Wolverhampton, in succession to his father. He is a practical chemist, and since his father retired from active participation in the business, has taken a leading part in its management.

The death is announced at Moseley, Birmingham, of MR. R. T. STEPHENS, aged thirty-seven. A son of the Rev. J. M. Stephens, he entered the employ of Messrs. J. & E. Sturge, Wheeleys Lane, Edgbaston and Lifford, chemical manufacturers, and had for many years been engaged at the latter works as an analytical chemist.

SWANSEA PATENT FUEL WORKERS have accepted new wage terms which involve an immediate reduction of 10 per cent. in piece work rates and 2s. per day in time rates, to be followed on April 1 by a further reduction of 5 per cent. and 1s. per day respectively, in addition to a stabilisation of wages in the event of the Board of Trade figures falling below 60 per cent.

On February 17 the Anglo-German Arbitration Tribunal dealt with a claim of the Zinc Corporation, Ltd., against A. Hersch & Son, of London and Australia, in respect of a dispute regarding the VALUE OF SPELTER. It was announced that the matter had been settled by the respondents' agreeing to pay to the claimants £25,000 in settlement, each party to pay its own costs.

CARTER & SONS, manufacturing chemists, of Attercliffe Road, Sheffield, whose works were destroyed by fire, gave notice to the Sheffield Employment Exchange that they intended to pay their workpeople's wages for last week. The employees number about 400, and the point has arisen whether workers unemployed by reason of fire are entitled to unemployment benefit.

AN INQUEST was held on February 18 at West Bromwich concerning the death of Mr. Thomas Ellis, of 57, High Street, Langley, a chemical plumber, employed by Albright & Wilson, Ltd., chemical manufacturers. He was repairing some overhead pipes when he overbalanced and fell to the ground, receiving severe injuries. He had been in the employ of the firm for over thirty years.

A MEETING of the Newcastle-on-Tyne Section of the Society of Chemical Industry will be held on March 1, when papers on "The Constitution of Golden Sulphide of Antimony as Used in the Rubber Industry," by A. Short and F. H. Sharpe, and "Outlines of Present Gas-Producer Types and Comparison Between the Utilisation, Efficiency and Producer and Other Gases," by N. E. Rambush, will be read.

The final transfer of the staff of NOBEL INDUSTRIES, LTD., to Nobel House, Buckingham Gate, London, S.W.1, has now been completed. The head office at 6, Cavendish Square, London, has been closed and all business and correspondence is now being conducted from the new headquarters of the company. For some months past workmen have been engaged in reconstructing the Buckingham Palace Hotel to make it suitable for offices and the work is now nearing completion.

A JOINT MEETING of the Faraday Society and the Oil and Colour Chemists' Association will be held on March 9 in the rooms of the Chemical Society, Burlington House, London, when a group of papers dealing with the properties of powders considered from various aspects will be read by Professor T. M. Lowry and Mr. L. C. McHatton, Professor P. G. H. Boswell, Dr. J. W. French, Dr. R. S. Morrell, Mr. C. A. Klein and Mr. W. J. Palmer and Mr. R. W. Whymper.

The North British Chemical Co. (England), Ltd., aniline dye manufacturers, of Droylesden, near Manchester, announce that they have opened a YORKSHIRE BRANCH at 15, Bridge Street, Bradford, under the management of Mr. Frank Cope, F.C.S. Mr. Cope will have the assistance of Mr. Harry Newell, a familiar personage in the Yorkshire woollen trade for over thirty years. The telegraphic address of the new offices is "Induline," Bradford; telephone, 5840, Bradford.

MR. J. L. BOWEN, at one time works manager of the Eastern Chemical Co., Ltd., Bombay, and technical manager and secretary of the Dharamsi Morarji Chemical Co., Ltd., Bombay, has recently returned to England. He is understood to be interested in several important projects for heavy chemical manufactures, &c., in India, and to have in view the organisation of adequate resources for their development. Communications from readers of THE CHEMICAL AGE interested will be forwarded to him.

Speaking at the annual meeting of the Electrolytic Zinc Co. of Australia, Ltd., held in Melbourne recently, the Hon. W. L. Baillieu said that up to the present their main object had been the completion of the 15,000 h.-p. unit to ensure at the earliest date the PRODUCTION OF SLAB ZINC. It was expected at first to produce 70 tons per day, to be increased to 85 tons before they switched on to the full charge of 30,000 h.-p., which the company anticipated doing by August next, when an output of over 120 tons of slab zinc per day was anticipated.

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Abstracts of Complete Specifications

174,099. Separating Aldehyde Fatty Acids from the by-products accompanying their Production, Process of—and the Manufacture of soaps from these Acids. C. P. Byrnes, Suite Entrance 1717, Farmers Bank Building, Pittsburgh, Pa., U.S.A. Application date, July 14, 1920.

The process is for obtaining aldehyde fatty acids from the compounds obtained by the oxidation of hydrocarbon vapours as described in specification 138,113 (*see* The Chemical Age, Vol. II. p. 362). The acids are converted into insoluble metallic derivatives, such as the calcium salts, which are separated from the impurities and then treated with an excess of hydrochloric acid to recover the fatty acids. Alternatively, the calcium salts are treated with an alkali salt to produce the alkali derivatives of the fatty acids. The fatty acids may be further purified by vacuum steam distillation, or they may be filtered through bone black, Fuller's earth, or the like. In another alternative, the insoluble lime soaps may be steam distilled. The fatty acids obtained may be used in the manufacture of soaps, or the insoluble soaps may be used for waterproofing fabrics.

174,101. Oxy-derivatives of Anthraquinone, Manufacture of. A. H. Davies and Scottish Dyes, Ltd., Murrell Hill Works, Carlisle. Application date, July 23, 1920.

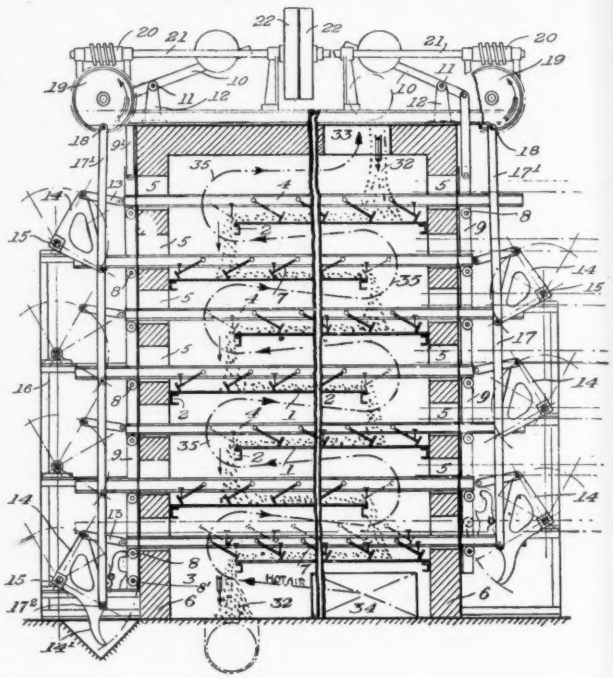
The process is more particularly for the production of alizarin. It has been found that the chlor-substituted derivatives of anthraquinone may be replaced by hydroxyl groups, and another hydroxyl group may be introduced by treating with a base in the presence of an oxidising agent. In an example, a mixture of 2-chlor-anthraquinone 78 parts, caustic soda 275 parts, sodium chlorate 11.3 parts, and water 850 parts is heated in an autoclave to 170°C. for twenty-four hours with stirring. The mixture is then diluted with water, boiled, filtered, extracted with boiling caustic soda, and acidified with dilute hydrochloric acid, and the alizarin filtered off.

174,106. Saturated Petroleum Products from Unsaturated Compounds, Process for Producing. A. J. Stephens, London. From the Canadian American Finance and Trading Co., Ltd. 511, Union Bank Building, Victoria, B.C., Canada. Application date, August 12, 1920.

Natural hydrocarbon oils and hydrocarbon oils obtained in the destructive distillation of coal usually contain unsaturated constituents, and the processes for treating them to obtain liquid petroleum products usually increase the amount of unsaturated compounds. In the present process, the hydrocarbon oils are vaporised, mixed with hydrogen, compressed, and the products condensed. The extent of hydrogenation depends on the concentration of the hydrogen in the vapour, the pressure, temperature, and time of the reaction, and the surface extent of catalytic material present. A pressure of 4-5 atmospheres is employed, and the hydrogen is kept in excess. The hydrogen is preferably obtained by heating waste material, or cheap hydrocarbons, in the presence of a catalyst to the dissociation temperature. Nickel may be used as the catalyst in the hydrogenation process.

174,124. Drying Pulverulent Granular or other Substances, Apparatus for. A. Hofmann, 10, Central Hill, Upper Norwood, London, S.E. 19. Application date, September 17, 1920.

The apparatus is of the kind in which the material to be dried is spread on a series of flat plates and subjected to the action of a current of hot air or gas. A series of trays 1 are supported one above the other on brackets 2 in the drying chamber, and extend alternately from opposite ends of the chamber partly through the chamber. Each tray is associated with a reciprocating horizontal frame 4, the ends of which pass through openings 5 in the walls. Each frame carries a set of rakes 7 to distribute the material on the tray. The frames 4 are supported on rollers 8 at each end and are connected by links 13 to sectors 14 journalled on rock-shafts 15. When the sectors are operated, the frames 4 are reciprocated in the direction of their length, and a separate set of sectors is provided for the alternate series of frames. All the sectors on one side are pivoted to a rod 17 the upper end of which is pivoted to a rotating disc 19 which thus reciprocates the rod. The lowest sector is provided with an extension 14^1 which is adapted to engage with a pin 8^1 on the vertical rod 9 to which all the frames 4 are pivoted, so that the frames are raised automatically at the end of their stroke. The rods 9 are attached by links 9^4 to counter-weighted levers 10. The material to be dried is introduced through the opening 33 on to



174,124

the uppermost tray, over which it is gradually raked so as to fall on to the next tray, and so on. Hot air or gas is supplied at 34 and passes upwards over the material as shown by the arrows. The rakes 7 rest by their own weight on or near the surface of the trays, and are raised and returned to their initial position after each stroke.

174,125. Formates of the Alkali Metals, Manufacture of. G. C. Bacon, London. From the Oldbury Electro Chemical Co., Niagara Falls, N.Y., U.S.A. Application date, September 17, 1920.

The process is for treating caustic alkali with carbon monoxide to obtain alkali metal formates, and the object is to obtain a better contact between the gas and the alkali solution, to ensure a more complete absorption of the gas. This is effected by using a finely divided solid in suspension in the alkali, which is inert to the alkali, but is capable of retaining minute bubbles of gas in contact with the liquid. A suitable solid material is calcium carbonate or oxalate which may have been obtained in another stage of the process. If the caustic alkali solution is obtained by treating sodium carbonate with calcium hydroxide, the resulting solution may be directly treated with carbon monoxide, without removing the precipitated calcium carbonate. In an alternative, use is made of the cyclic process described in specification 160,747 (*see* The Chemical Age, Vol. IV., p. 626). Caustic soda is treated under heat and pressure with carbon monoxide to produce sodium formate, which is converted into the oxalate under the action of heat. The sodium oxalate is converted into calcium oxalate and caustic soda by treatment with calcium hydroxide and the caustic soda is then treated with more carbon monoxide and so on. The calcium oxalate is left in the solution to facilitate contact of the gas and liquid as indicated above.

174,126. Oxalates of the Alkali Metals, Manufacture of. G. C. Bacon, London. From the Oldbury Electro Chemical Co., Niagara Falls, N.Y., U.S.A. Application date, Sept. 17, 1920.

In converting sodium formate into the oxalate by placing the solid formate into a heated vessel and heating it rapidly

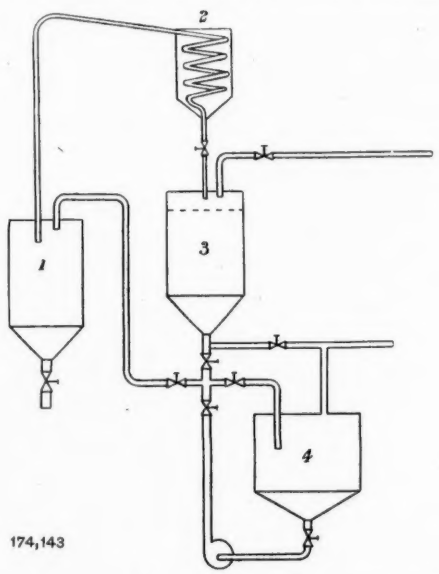
to the conversion temperature, difficulties are experienced in the heating of large masses of solid formate due either to overheating near the walls, due to bad conductivity, or underheating of the whole mass in an attempt to avoid overheating. If the conversion of the formate is allowed to take place at temperatures below 380°C., the yield is reduced, and the proportion of sodium carbonate increased. In the present invention, the formate is melted in a separate vessel below the conversion temperature of 295°C., and then transferred to the reaction vessel, which is heated to 440°C., where its temperature is raised to 380°-440°C. The conversion is exothermic, and the heat liberated ensures a rapid rise of temperature to the required amount. In these circumstances a yield of 90 per cent. of oxalate can be obtained. Caustic alkali may also be added to the formate immediately before running it into the reaction vessel, to improve the yield.

174,136. LEUCO ALIZARIN BORDEAUX AND DERIVATIVES THEREOF, MANUFACTURE OF. W. H. Dawson, of British Alizarine Co., Ltd., Silvertown, London, E. 16. Application date, October 7, 1920.

It is found that alizarin bordeaux or its halogen derivatives may be reduced by means of alkaline hydrosulphite solutions, yielding a product which is more easily handled and less readily oxidised on drying than that obtained by reducing with zinc and caustic soda. The reduction is effected in a hot solution and the mixture is then poured into dilute hydrochloric acid, and the precipitate filtered, washed, and dried. It is found that when the leuco compound is precipitated in a hot solution a larger yield is obtained when condensing the product with aromatic amines such as *p*-toluidine.

174,143. SULPHUR, PROCESS AND APPARATUS FOR THE EXTRACTION OF. J. Y. Johnson, London. From Badische Anilin & Soda Fabrik, Ludwigshafen-on-Rhine, Germany. Application date, October 12, 1920.

Active charcoal, which has been used for extracting sulphur from gases, is treated with ammonium sulphide solution to purify it and recover the sulphur. Ammonium sulphide solution is heated to boiling point in a vessel 1, and the vapour



174,143

is condensed in a condenser 2, giving a strong solution of ammonium sulphide, which then passes through the sulphur-bearing mass in the vessel 3. The solution then returns to the vessel 1, where it is again distilled and the sulphur deposited. The process is continued until the sulphur is all extracted, which is indicated by the lack of colour in the solution. The process may be commenced with free ammonia or ammonium carbonate in the vessel 1. It is found that dilute ammonium sulphide containing not more than 30 grammes of sulphur per litre gives the best results. If the distillation is continued, a distillate of pure water is finally obtained and the active charcoal is washed with it. In this case the water may be run into the vessel 4 instead of returning to the vessel 1. The extracted sulphur is then withdrawn from the vessel 1, the water returned from the vessel 4, and the process recommenced with another quantity of charcoal. It is found that the sulphur may be caused to separate in a granular condition in the vessel 1 if an electrolyte inert to ammonium sulphide is added, such as common salt. This process may be combined with a process for extracting sulphuretted hydrogen from gases by oxidation with air, using active charcoal as a catalyst, and both processes may be carried out without removing the charcoal from the extraction vessel. The purified charcoal may be dried by superheated steam or by hot gases. The apparatus is preferably constructed of aluminium, and the extraction is effected in an inert or reducing atmosphere.

174,165. ILLUMINATING GAS AND BY-PRODUCTS, MANUFACTURE OF. J. Moeller, Bridestowe, Devon, and L. de Fonblanque, Guildford House, Farnham. Application date, October 16, 1920.

Coal and other carbonaceous materials are distilled at low temperatures by means of a gas rich in hydrogen, mixed with superheated steam at 500°-600°C. The condensable hydro-

Fig. 2

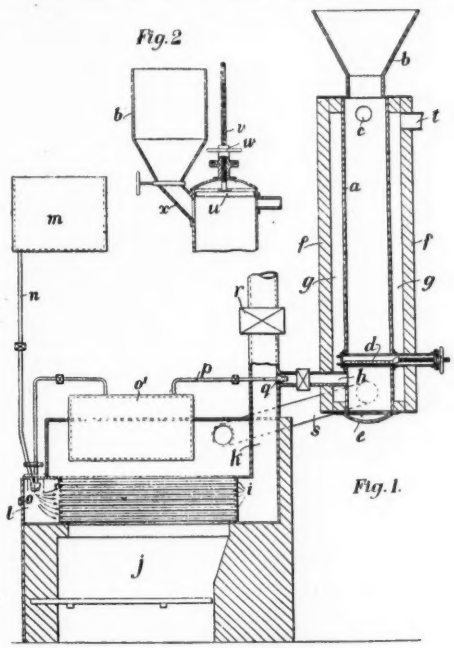


Fig. 1.

174,165

carbons may be fractionated, and the light oils further treated to produce motor spirit. The heavier oils are passed with highly superheated steam through small iron pipes heated to 800°-1,000°C., yielding a fixed gas containing 60-75 per cent. of hydrogen, which is used for distilling the coal. The temperature is reduced to 500°-600°C. and the gas mixed with 20-25 per cent. of superheated steam for this purpose. A hard coke is obtained as a residue, containing 5-8 per cent. of hydrocarbons. If a metallurgical coke is required, the gas and steam mixture is raised to 700°-900°C. during the last stages of the distillation. The coal is fed from a hopper *b* into a retort *a*, where it rests on a perforated grid *d*. The gases are drawn off through the outlet *c*, and the coke through the outlet *e* on withdrawing the grid *d*. Heavy oil is supplied from a tank *m* to a vaporising chamber *l*, where it is mixed with superheated steam from the boiler o^1. The mixture passes through the iron pipes *i* heated by a furnace *j*, and then passes through the pipe *h* to the retort. Steam is added through the nozzle *q*. Hot waste gases from the furnace pass through a pipe *s* to the space *g* surrounding the retort. A ram *u* may be used for consolidating the charge to obtain a dense, hard coke.

NOTE.—Abstracts of the following specifications which are now accepted appeared in THE CHEMICAL AGE when they became open to inspection under the International Convention: 151,016 (H. John) relating to condensation products of formaldehyde and carbamide or carbamide derivatives, *see* Vol. III., p. 635; 152,650 (Colombo and Ing. de Bartolomeis,

and R. de Bartolomeis) relating to distillation of fuels, *see* Vol. IV., p. 49; 152,668 (H Strache) relating to combustion of bituminous fuels and by-product recovery, *see* Vol. IV., p. 82; 152,960 (F. Fischer) relating to organic reactions at temperatures of red heat or above, *see* Vol. IV., p. 105.

International Specifications not yet Accepted

173,230. Colloidal Solutions and Emulsions. L. Lilienfeld, 1, Zeltgasse, Vienna. International Convention date, December 21, 1920. Addition to 156,725.

Specification 156,725 describes the production of colloidal solutions, suspensions or emulsions by the aid of alkyl or aralkyl ethers of cellulose, starch, dextrin, and other carbohydrates. In the present invention, the ether employed is soluble in cold water, but insoluble lin hot water, so that it is precipitated when the colloidal solution is heated, together with the colloidal substance. The colloidal substance may then be dissolved again in cold water. Colloidal solutions of gold, silver, mercury, copper, tin, palladium, platinum, iridium, osmium, sulphur, selenium, tellurium, and inorganic and organic substances may thus be obtained. As an example, gold chloride solution is treated with an aqueous solution of a water-soluble ethyl or methyl cellulose and the reduction to metallic gold is effected by hydrazine hydrate or hydroxylamine hydrochloride. The colloidal solution of gold is heated, the precipitate washed with hot water, and then redissolved in cold water or dried. As an alternative, the colloidal substance previously dissolved in water or in another protective colloid may be added to the ether.

173,236. Extracting Refractory Metals. Westinghouse Lamp Co., Bloomfield, N.J., U.S.A. (Assignees of J. W. Marden, 2116, Braddock Avenue, Swissvale, Pa., U.S.A.). International Convention date, December 21, 1920.

The metal compound is reduced by heating with another metal and all the salts formed in the reduction process are then volatilised by raising the temperature, leaving the refractory compound. The process is applicable to the reduction of zirconium, titanium, uranium, thorium, vanadium, and tungsten. In an example, a salt such as zirconium potassium fluoride, potassium titanium fluoride, uranium fluoride, or thorium tetrachloride is mixed with aluminium or iron, and heated *in vacuo* in a molybdenum crucible in an electric induction furnace. The temperature is then raised sufficiently to volatilise all compounds except the zirconium or other metal.

173,237. Treating Refractory Metals. Westinghouse Lamp Co., Bloomfield, N.J., U.S.A. (Assignees of J. W. Marden, 2116, Braddock Avenue, Swissvale, Pa., U.S.A., and H. C. Rentschler, 1249, Murdock Street, Pittsburg, Pa., U.S.A.). International Convention date, December 21, 1920.

Zirconium, thorium, titanium, uranium, vanadium, tantalum, tungsten or beryllium in powder form, or mixtures, or oxides, are heated in a high vacuum to eliminate occluded gases. The powder is then strongly heated in or on a molybdenum crucible or plate by means of a surrounding coil through which a direct or low-frequency alternating current is passed, followed by a high-frequency alternating current. The metal is thus obtained in a coherent sintered form.

Latest Notifications

175,235. Manufacture of Alcohol Badische Anilinund Soda-Fabric. February 10, 1921.

175,273. Bodies for filling Columns, towers or the like, through which gas is passed, in an opposite direction to liquid. Petzel, G. March 17, 1920.

175,281. Filter-bag clearing devices for air filters. Bell, W. F. L. February 12, 1921.

175,285. Removal of phenol and its homologues from waste waters. Posseyer Abwasser und Wasserreinigungs.Ges.; E. February 10, 1921.

Specifications Accepted, with Date of Application

154,579. Aldehyde and acetic acid, Production of. A. Wohl. November 24, 1919.

156,187. Metallic mercury, Process for regenerating. Chemische Fabriken Worms Akt.-Ges. January 24, 1919.

172,270. Dry gas purifiers. Halbergerhütte Ges. December 1, 1920.

174,653. Sodium compounds and by-products, Manufacture of. E. E. Naef. November 10, 1920.

174,656. Phenolic condensation products, Manufacture of. H. Wade. (*Redmanol Chemical Products Co.*) July 29. 1920.

174,660. Films, celluloid-like masses, blocks, and other products or articles, Manufacture of. H. Dreyfus. August 4, 1920.

174,676. Carbonising carbonaceous materials, Process for. G. W. Wallace. September 24, 1920.

174,690. Heating materials at successively different temperatures, Method of and apparatus for. Thermal Industrial and Chemical (T.I.C.) Research Co., Ltd., Sir A. M. Duckham and J. S. Morgan. October 20, 1920.

174,700. Tanning. J. Y. Johnson. (*Badische Anilin & Soda Fabrik.*) October 26, 1920.

174,702. A product adapted particularly for sanitary, medicinal and therapeutic uses, Process for producing. J. N. A. Sauer. October 26, 1920.

174,739. Separating minerals and other substances, Method of—and apparatus therefor. S. Nettleton. November 2, 1920.

174,784. Anthraquinone, Process for the purification of. W. H. Dawson. November 16, 1920.

174,877. Tar-distillation and like stills. C. Benn, C. H. Benn, and C. L. Benn. March 18, 1921.

174,878. Ammonium sulphate, Manufacture of. South Metropolitan Gas Co. E. V. Evans, P. Parrish, and O. W. Weight. March 18, 1921.

Applications for Patents

Aris, G. Production of phenylamine black, and process of dyeing therewith. 4737. February 17. (Spain, March 1, 1921.)

Ashcroft, E. A. Electrolysing fused salts of metals and recovering metals and acid radicles, &c. 4835. February 18.

Bell Bros., Ltd., Powell & Co. Apparatus for drying salts, &c. 4508. February 15.

Blanc, C. A. Method for separation of chlorides of aluminium and potassium present in mixed solutions obtained in the treatment of leucite. 4435. February 15. (Italy, March 7, 1921.)

Blanc, G. A. Treatment of silicates to obtain saline solutions free from silica. 4436. February 15. (Italy, June 14, 1921.)

Blanc, G. A. Methods for treatment of alum to obtain sulphates of potassium with ammonium and free alumina. 4437. February 15. (Italy, June 16, 1921.)

Bollmann, H. Process for separating extractive matters from organic constantly-boiling solutions of mixtures of solvents and for recovering the latter. 4720. February 17.

Bollmann, H. Decolorisation and purification of fats and oils. 4719. February 17.

British Cellulose & Chemical Manufacturing Co., Ltd. Manufacture of textile products. 4832. February 18.

Deutsche; Gold & Silver-Scheideanstalt vrom Rossler, Rossler and Liebknecht, O. Method for producing solutions containing hydrogen peroxide. 4610. February 16.

Duckham, Sir A. M. Manufacture of ore or fuel briquettes, &c. 4863. February 18.

Egeling, H. Saturators for recovery of salts from gases of dry distillation. 4745. February 17. (Germany, February 17, 1921.)

Hawthorn, E., King, P. H. and Mortimore, W. C. Process for purifying oils containing sulphur. 4607. February 16.

Hutton, H. W. Hydrometer, &c., for indicating proportions of ingredients of emulsions, &c. 4555. February 16.

Imray, O. Y. (Soc. of Chemical Industry in Basle). Manufacture of azo dye-stuffs. 4626. February 16.

Jennings, H. W. K. Chlorination of mineral wax or ozokerite. 4581. February 16.

Johnson, J. Y. (Badische Anilin and Soda Fabrik). Treating wood. 4323. February 14.

Lucke, H. J. Deriving hydrazobenzol, &c. 4492. February 15.

Moscicki, I. Dry distillation of bituminous or cellulose-containing material. 4629. February 16.

Nihon Glycerine Kogyo Kaisha. Method of manufacturing hydrocarbon oils from oils, fats, and fatty acids. 4617. February 16. (Japan, February 25, 1921.)

Pease & Partners, Ltd., and Stephenson, G. Manufacture of sulphate of ammonia. 4224. February 13.

Quinan, K. B. Distillation of hydrocarbon-yielding material. 4738. February 17.

Soc. Chimique de la Grande-Paroisse (Azote & Produits Chimiques). Purification of gases for synthetic production of ammonia. 4773. February 17. (France, March 25, 1921.)

Thermal Industrial & Chemical (T.I.C.) Research Co., Ltd. Pumps. 4751. February 17.

United Kingdom Oil Co., Ltd. Treatment and production of hydrocarbons. 4576. February 16.

Wolvekamp, M. E. Organic mercury derivatives of aurin tricarboxylic acid and their alkali salts. 4370. February 14.

Wolvekamp, M. E. Soluble combinations with a colloidal sulpharsenite. 4371. February 14.

Wolvekamp. M. E. Colloidal compounds of antimony sulphide. 4372. February 14.

Market Report and Current Prices

Our Market Report and Current Prices are exclusive to THE CHEMICAL AGE, *and, being independently prepared with absolute impartiality by Messrs. R. W. Greeff & Co., Ltd., and Messrs. Chas. Page & Co., Ltd., may be accepted as authoritative. The prices given apply to fair quantities delivered ex wharf or works, except where otherwise stated. The weekly report contains only commodities whose values are at the time of particular interest or of a fluctuating nature. A more complete report and list are published once a month. The current prices are given mainly as a guide to works managers, chemists, and chemical engineers; those interested in close variations in prices should study the market report.*

LONDON, FEBRUARY 23, 1922.

A FEELING of greater confidence is steadily developing, and whilst business is still largely confined to prompt requirements, the turnover is improving.

There is a distinct shortage in spot supplies of a number of products, and prices generally are inclined to be firmer.

The export inquiry is poor and no considerable volume of business can be detected.

General Chemicals

ACETONE is in active demand, and spot supplies command a premium.

ACID ACETIC remains a very firm market. Inquiry is fairly active and higher prices fully maintained.

ACID FORMIC remains in good inquiry, with prices tending upwards.

ACID LACTIC is only in small demand, but very firm in price.

ACID OXALIC is much firmer in price. The stocks which did not pay duty are practically exhausted, and a further advance is expected.

ACID TARTARIC.—A certain amount of hand-to-mouth buying is reported, the position remaining easy.

BLEACHING POWDER.—The position has materially improved, and the deliveries of the home makers are much more satisfactory. Export inquiry remains good.

CALCIUM CARBIDE is unchanged.

COPPER SULPHATE remains a nominal market, due to the continued absence of export orders.

FORMALDEHYDE.—The demand is quiet, but stocks are firmly held.

LEAD ACETATE is in better demand, but the turnover is far from satisfactory.

LEAD NITRATE is unchanged.

LITHOPONE has been in good inquiry, and a fair business is passing.

POTASSIUM CARBONATE is featureless.

POTASSIUM CAUSTIC.—The tendency still favours buyers, supplies for spot and forward being considerably in excess of the demand.

POTASSIUM PRUSSIATE.—A good business is reported, especially for prompt delivery, and the price is very firm.

SODIUM ACETATE remains in good demand; price unchanged.

SODIUM BICHROMATE.—The price continues to droop, due apparently to forced realisations which the market finds it difficult to absorb.

SODIUM CHLORATE shows a slightly better demand, without alteration in price.

SODIUM NITRITE is in very limited inquiry, and business passing is almost nominal.

SODIUM PRUSSIATE is weaker for prompt delivery. This was only to be expected, as supplies from the makers are now becoming available, and the premium for spot has accordingly been reduced. Makers' supplies are firmly held for both early and forward delivery.

ZINC OXIDE is featureless.

Coal Tar Intermediates

Trade has continued on quiet lines, but a certain amount of interest is about, on both home and export account, and stocks of a number of intermediates are getting bare.

ALPHA NAPHTHOL has been in fair demand, some fair home trade orders having been booked. Makers' stocks are low.

ALPHA NAPHTHYLAMINE has been inquired for for forward delivery, and the price is steady.

ANILINE OIL and SALT continue to pass quietly into consumption, and some makers are fairly well sold.

BETA NAPHTHOL is the turn firmer, and the usual business is passing.

BETA NAPHTHYLAMINE has been inquired for, but little business is actually passing.

DICHLORBENZENE has been asked for on export account.

DIMETHYLANILINE.—A few good orders have been booked, and the price is steady.

DIPHENYLAMINE is interesting, both for home and export, and the price is very firm.

"G" SALT is featureless.

"H" ACID is very firm, and some home trade business has been booked.

METANITRANILINE has been inquired for, but in small quantities.

PARAMIDOPHENOL is slightly more interesting, both for home and for foreign markets.

PARANITRANILINE is steady.

PARAPHENYLENEDIAMINE continues firm at last quoted prices.

"R" SALT is without change.

Coal Tar Products

THE demand for most coal tar products is very moderate, and in many cases prices are very weak.

90's BENZOL is plentiful and can be bought at 2s. 4½d. on rails at the makers' works.

PURE BENZOL is in poor demand and is worth about 2s. 8d. to 2s. 9d. on rails in the North and about 3s. on rails in the South.

CRESYLIC ACID is also plentiful, and is quoted at 2s. on rails for the Pale quality and 1s. 9d. on rails for the Dark 95/97 per cent.

SOLVENT NAPHTHA is fairly quiet at 2s. 4d. on rails.

HEAVY NAPHTHA 90/190 is in poor demand, and is worth about 2s. on rails.

NAPHTHALENE is weak. Crude qualities are worth from £5 to £7, and Refined from £15 to £17 per ton.

PITCH shows little change in price.

Sulphate of Ammonia

There is no change to report.

Current Prices

Chemicals

	Per	£	s.	d.		£	s.	d.
Acetic anhydride	lb.	0	1	10	to	0	2	0
Acetone oil	ton	87	10	0	to	90	0	0
Acetone, pure	ton	80	0	0	to	82	10	0
Acid, Acetic, glacial, 99-100%	ton	55	0	0	to	60	0	0
Acetic, 80% pure	ton	47	0	0	to	48	0	0
Arsenic	ton	90	0	0	to	95	0	0
Boric, cryst	ton	65	0	0	to	68	0	0
Carbolic, cryst. 39-40%	lb.	0	0	6½	to	0	0	7
Citric	lb.	0	1	11	to	0	2	0
Formic, 80%	ton	72	10	0	to	75	0	0
Gallic, pure	lb.	0	3	6	to	0	3	9
Hydrofluoric	lb.	0	0	8½	to	0	0	9
Lactic, 50 vol.	ton	40	0	0	to	43	0	0
Lactic, 60 vol.	ton	43	0	0	to	45	0	0
Nitric, 80 Tw.	ton	30	0	0	to	31	0	0
Oxalic	lb.	0	0	8½	to	0	0	9
Phosphoric, 1.5	ton	43	0	0	to	45	0	0
Pyrogallic, cryst.	lb.	0	6	9	to	0	7	0
Salicylic, Technical	lb.	0	0	10½	to	0	1	0
Salicylic, B.P.	lb.	0	1	4	to	0	1	6
Sulphuric, 92-93%	ton	8	0	0	to	8	10	0
Acid Tannic, commercial	lb.	0	2	9	to	0	3	0
Tartaric	lb	0	1	3	to	0	1	4
Alum, lump	ton	12	10	0	to	13	0	0
Alum, chrome	ton	30	10	0	to	32	0	0
Alumino ferric	ton	9	0	0	to	9	10	0
Aluminium, sulphate, 14-15%	ton	12	0	0	to	13	0	0
Aluminium, sulphate, 17-18%	ton	13	10	0	to	14	10	0
Ammonia, anhydrous	lb.	0	1	8	to	0	1	10
Ammonia, .880	ton	35	0	0	to	37	0	0
Ammonia, .920	ton	22	0	0	to	24	0	0
Ammonia, carbonate	lb.	0	0	4	to	—		
Ammonia, chloride	ton	60	0	0	to	65	0	0

	Per	£	s.	d.		£	s.	d.
Ammonia, muriate (galvanisers)..	ton	35	0	0	to	37	10	0
Ammonia, nitrate	ton	55	0	0	to	60	0	0
Ammonia, phosphate.....	ton	90	0	0	to	95	0	0
Ammonia, sulphocyanide.....	lb.	0	3	0	to	—		
Amyl acetate	ton	150	0	0	to	160	0	0
Arsenic, white, powdered.....	ton	42	0	0	to	44	0	0
Barium, carbonate, 92-94%.....	ton	12	10	0	to	13	0	0
Barium, Chlorate	lb.	0	0	11	to	0	1	0
Chloride	ton	14	10	0	to	15	10	0
Nitrate	ton	40	0	0	to	42	0	0
Sulphate blanc fixe, dry	ton	24	0	0	to	25	0	0
Sulphate, blanc fixe, pulp....	ton	15	0	0	to	16	0	0
Sulphocyanide, 95%.....	lb.	0	1	6	to	0	1	0
Bleaching powder, 35-37%.....	ton	14	0	0	to	—		
Borax crystals.....	ton	31	0	0	to	32	0	0
Calcium acetate, Brown.....	ton	8	0	0	to	9	0	0
,, ,, Grey	ton	10	0	0	to	11	0	0
Calcium Carbide.....	ton	16	0	0	to	17	0	0
Chloride	ton	7	10	0	to	8	0	0
Carbon bisulphide	ton	60	0	0	to	62	0	0
Casein, technical.....	ton	75	0	0	to	80	0	0
Cerium oxalate.....	lb.	0	3	6	to	0	3	9
Chromium acetate.....	lb.	0	1	1	to	0	1	3
Cobalt acetate.....	lb.	0	11	0	to	0	11	6
Oxide, black	lb.	0	10	6	to	0	11	0
Copper chloride.....	lb.	0	1	3	to	0	1	0
Sulphate	ton	28	10	0	to	29	0	0
Cream Tartar, 98-100%.....	ton	120	0	0	to	125	0	0
Epsom salts (*see* Magnesium sulphate)								
Formaldehyde, 40% vol	ton	82	0	0	to	83	0	0
Formusol (Rongalite).....	lb.	0	3	9	to	0	4	0
Glauber salts, commercial.....	ton	4	5	0	to	4	10	0
Glycerine, crude.....	ton	70	0	0	to	72	10	0
Hydrogen peroxide, 12 vols.....	gal.	0	2	5	to	0	2	6
Iron perchloride	ton	30	0	0	to	32	0	0
Iron sulphate (Copperas)	ton	4	0	0	to	4	5	0
Lead acetate, white	ton	45	0	0	to	47	0	0
Carbonate (White Lead).....	ton	40	0	0	to	44	0	0
Nitrate	ton	48	10	0	to	50	10	0
Litharge	ton	35	10	0	to	36	0	0
Lithopone, 30%	ton	26	0	0	to	27	0	0
Magnesium chloride.....	ton	10	10	0	to	11	0	0
Carbonate, light.....	cwt.	2	10	0	to	2	15	0
Sulphate (Epsom salts commercial)	ton	9	10	0	to	10	0	0
Sulphate (Druggists').....	ton	14	10	0	to	15	10	0
Manganese, Borate.....	ton	70	0	0	to	75	0	0
Sulphate	ton	70	0	0	to	75	0	0
Methyl acetone.....	ton	85	0	0	to	90	0	0
Alcohol, 1% acetone	ton	75	0	0	to	77	10	0
Nickel sulphate, single salt.....	ton	61	0	0	to	62	0	0
Ammonium sulphate, double salt	ton	62	0	0	to	64	0	0
Potash, Caustic.....	ton	34	0	0	to	35	0	0
Potassium bichromate.....	lb.	0	0	7¾	to	—		
Carbonate, 90%.....	ton	31	0	0	to	33	0	0
Chloride 80%	ton	15	0	0	to	20	0	0
Chlorate	lb.	0	0	4½	to	0	0	5
Meta bisulphite, 50-52%.....	ton	112	0	0	to	120	0	0
Nitrate, refined.....	ton	45	0	0	to	47	0	0
Permanganate	lb.	0	0	9	to	0	0	10
Prussiate, red.....	lb.	0	2	4	to	0	2	6
Prussiate, yellow	lb.	0	1	2	to	0	1	2½
Sulphate, 90%	ton	20	0	0	to	22	0	0
Salammoniac, firsts	cwt.	3	5	0	to	—		
Seconds	cwt.	3	0	0	to	—		
Sodium acetate	ton	25	0	0	to	26	0	0
Arsenate, 45%	ton	45	0	0	to	48	0	0
Bicarbonate	ton	10	10	0	to	11	0	0
Bichromate	lb.	0	0	5¾	to	—		
Bisulphite, 60-62%	ton	25	0	0	to	27	10	0
Chlorate	lb.	0	0	3¾	to	0	0	4
Caustic, 70%	ton	24	0	0	to	24	10	0
Caustic, 76%	ton	25	10	0	to	26	0	0
Hydrosulphite, powder, 85%	lb.	0	2	3	to	0	2	6
Hyposulphite, commercial...	ton	13	10	0	to	14	0	0
Nitrite, 96-98%	ton	37	10	0	to	40	0	0
Phosphate, crystal.....	ton	20	10	0	to	21	0	0
Perborate.....	lb.	0	1	2	to	0	1	3
Prussiate	lb.	0	0	9½	to	0	0	10
Sulphide, crystals	ton	13	0	0	to	14	0	0
Sulphide, solid, 60-62%.....	ton	24	10	0	to	25	0	0
Sulphite, cryst.....	ton	13	0	0	to	14	0	0
Strontium carbonate.....	ton	60	0	0	to	65	0	0
Strontium Nitrate.....	ton	60	0	0	to	62	10	0
Strontium Sulphate, white.....	ton	7	10	0	to	8	10	0
Sulphur chloride.....	ton	25	0	0	to	27	10	0
Sulphur, Flowers.....	ton	13	0	0	to	14	0	0
Roll	ton	13	0	0	to	14	0	0
Tartar emetic.....	lb.	0	1	6½	to	0	1	7

Coal Tar Intermediates, &c.

	Per	£	s.	d.		£	s.	d.
Alphanaphthol, crude.....	lb.	0	2	3	to	0	2	6
Alphanaphthol, refined.....	lb.	0	2	9	to	0	3	0
Alphanaphthylamine	lb.	0	2	0	to	0	2	3
Aniline oil, drums extra.....	lb.	0	1	0	to	0	1	1
Aniline salts.....	lb.	0	1	1	to	0	1	2
Anthracene, 40-50%.....	unit	0	0	8½	to	0	0	9
Benzaldehyde (free of chlorine)...	lb.	0	3	9	to	0	4	3
Benzidine, base	lb.	0	5	9	to	0	6	0
Benzidine, sulphate.....	lb.	0	5	9	to	0	6	0
Benzoic acid.....	lb.	0	1	10	to	0	2	0
Benzoate of soda.....	lb.	0	1	9	to	0	1	11
Benzyl chloride, technical.....	lb.	0	2	0	to	0	2	3
Betanaphthol benzoate.....	lb.	0	4	9	to	0	5	0
Betanaphthol	lb.	0	1	9	to	0	2	0
Betanaphthylamine, technical....	lb.	0	6	0	to	0	7	0
Croceine Acid, 100% basis.....	lb.	0	3	6	to	0	3	9
Dichlorbenzol	lb.	0	0	9	to	0	0	10
Diethylaniline	lb.	0	2	9	to	0	3	0
Dinitrobenzol	lb.	0	1	3	to	0	1	4
Dinitrochlorbenzol	lb.	0	0	10	to	0	1	0
Dinitronaphthaline	lb.	0	1	4	to	0	1	5
Dinitrotoluol	lb.	0	1	5	to	0	1	6
Dinitrophenol	lb.	0	2	9	to	0	3	0
Dimethylaniline	lb.	0	2	6	to	0	2	9
Diphenylamine	lb.	0	6	4	to	0	0	4
H-Acid	lb.	0	6	6	to	0	7	0
Metaphenylenediamine	lb.	0	5	6	to	0	5	9
Monochlorbenzol	lb.	0	0	10	to	0	1	0
Metanilic Acid.....	lb.	0	6	0	to	0	6	6
Monosulphonic Acid (2.7).....	lb.	0	5	6	to	0	6	0
Naphthionic acid, crude.....	lb.	0	3	3	to	0	3	6
Naphthionate of Soda.....	lb.	0	3	3	to	0	3	6
Naphthylamin-di-sulphonic-acid ..	lb.	0	4	0	to	0	4	3
Nitronaphthalene	lb.	0	1	4	to	0	1	5
Nitrotoluol	lb.	0	1	0	to	0	1	2
Orthoamidophenol, base.....	lb.	0	10	0	to	0	10	5
Orthodichlorbenzol	lb.	0	1	0	to	0	1	1
Orthotoluidine	lb.	0	1	6	to	0	1	9
Orthonitrotoluol	lb.	0	0	10	to	0	1	0
Para-amidophenol, base	lb.	0	10	0	to	0	10	6
Para-amidophenol, hydrochlor....	lb.	0	10	6	to	0	11	0
Paradichlorbenzol	lb.	0	0	6	to	0	0	7
Paranitraniline	lb.	0	3	6	to	0	3	9
Paranitrophenol	lb.	0	2	3	to	0	2	6
Paranitrotoluol	lb.	0	5	0	to	0	5	3
Paraphenylenediamine, distilled ..	lb.	0	11	0	to	0	11	6
Paratoluidine	lb.	0	7	0	to	0	7	6
Phthalic anhydride.....	lb.	0	2	9	to	0	3	0
Resorcin, technical	lb.	0	5	6	to	0	6	0

Potash

DURING the past week the demand for potash salts has been fairly brisk. Supplies are now being ordered for the spring sown crops, and buyers are particularly concerned in obtaining the more concentrated grades, such as sylvinite 20 and 30 per cent. These qualities are also much in request for the manufacture of compound manures. The very favourable prices at which potash salts are now being offered have caused a certain falling off in the demand for muriate and sulphate of potash, although there is still a fair turnover of these grades in the horticultural districts. Current quotations remain as follows :—

Kainit	14% (K_2O)	£2 12 6	per ton f.o.r.	in bags.
Sylvinite	20% ,,	£3 12 6	,, ,,	,,
Sylvinite	30% ,,	£5 12 6	,, ,,	,,
Muriate of Potash	50% ,,	£10 10 0	,, ,,	,,
Sulphate of Potash	90% purity	£14 10 0	,, ,,	,,

With regard to kainit (a correspondent states) the practice of selling with a higher percentage of potash than that guaranteed seems to be gaining ground, but buyers are sceptical about allowing a higher price for the alleged percentage of potash in excess of guaranteed amount. Kainit 12.4 per cent. is described as having as much as 14 per cent. of potash, while French kainit, which is guaranteed to contain 14 per cent. of potash, may be sold as 16 per cent.

The demand for potash fertilisers is well maintained ; Kainit and sulphate of potash at present level of prices are much in favour and going into consumption at a rapidly increasing rate. The growing volume of evidence as to the better effect of sulphate of potash on the quality of potatoes is turning back to sulphate of potash many growers who adopted chloride dressings when they were much cheaper, as compared with sulphate of potash, than they are to-day.

Scottish Chemical Market

The following notes on the Scottish Chemical Market are specially supplied to THE CHEMICAL AGE *by Messrs. Charles Tennant and Co., Ltd., Glasgow, and may be accepted as representing the firm's independent and impartial opinions.*

GLASGOW, FEBRUARY 22, 1922.

THE past week has justified expectations of steady, if slow, improvement in the general chemical trade.

Export inquiries have been numerous and some good orders have been booked. Alkali products are in good request for export.

The home consumption still leaves much to be desired.

The price of sulphuric acid has been reduced by 10s. to 15s. per ton according to quality. Makers have also reduced the price of muriatic acid by 6d. per carboy. These reductions have not been sufficient, however, to stimulate much buying.

Numerous quotations are coming in from the Continent for chemicals, but delivery is very uncertain.

In coal tar products and intermediates there has been an undoubted improvement and numerous inquiries of small dimensions have been on the market for home and export.

Industrial Chemicals

ACETONE.—Consumers have filled immediate wants and are now content to wait for expected lower quotations. To-day's value may be called £65 to £70 per ton according to quality.

ACID, ACETIC (GLACIAL).—Market is still firm at £55 to £65 per ton. A few inquiries for lower strengths: 40 per cent. technical quoted £26 to £27 per ton; B.P. 20s. per ton extra. 80 per cent. technical quoted £46 to £47 per ton; and B.P. 40s. per ton extra.

ACID, BORACIC.—No change in price. Crystals, £65 per ton. Powdered, £67 per ton, bags included, ton lots.

ACID, MURIATIC.—Prices reduced; now 6s. 6d. per carboy ex works. Business still very quiet.

ACID, NITRIC, 80°.—Slight demand for local consumption. Price £25 10s. per ton.

ACID, OXALIC.—Market firm at 9½d. per lb. Some cheap Continental quotations at 8½d. c.i.f., but delivery uncertain.

ACID, SULPHURIC.—Reduction of 10s. to 15s. per ton according to quality. Price in carboys: Pyrites, 144°, £4; Pure, 144°, £5; 168°, £7 5s.; Pure, 168°, £8 5s. Ex works in full wagon loads.

ALUM, AMMONIA.—Lump Continental, £14 per ton, ex quay. English, £16 per ton. Orders light.

ALUM, POTASH.—A few inquiries. Some business done at £15 10s. per ton f.o.r. Continental quotations slightly dearer.

ALUMINA SULPHATE.—Home make, 17/18 per cent., £15 per ton; 14/15 per cent., £13 per ton f.o.r.; Continental quotations, 17/18 per cent., £10 10s. per ton c.i.f.

AMMONIA, MURIATE (Galvanisers).—Price remains unchanged at £34 to £35 per ton f.o.r.

AMMONIA, MURIATE (Salammoniac).—A few inquiries for small lots, price £62 per ton f.o.r.

AMMONIA, SULPHATE.—Steady demand with no change in price. 25¼ per cent. £15 10s. per ton; 25¾ per cent., £16 13s. per ton.

ARSENIC, WHITE POWDERED.—Market slightly firmer at £41 per ton ex works.

BARIUM, CHLORIDE.—Practically no demand. Quoted slightly cheaper at £14 5s. f.o.r.

BARYTES.—Price remains firm at £6 per ton f.o.r. works for fine white quality; Grey, £4 per ton. Continental offers round about the same prices c.i.f. U.K. port.

BORAX.—No change in price. Slight inquiry for small quantities. Crystal, £31 per ton; powdered, £32 per ton. In 2 cwt. bags, minimum ton lots.

CALCIUM CARBIDE.—Steady demand for small lots. No change in price at £20 per ton delivered.

CALCIUM CHLORIDE.—Price for home product remains unchanged at £7 10s. ex quay. Continental offers at 15s. to 20s. per ton less.

COPPER SULPHATE.—Market easier. Quoted £25 to £27 per ton f.o.r. U.K. ports.

COPPERAS, GREEN.—Very little demand at £5 per ton in casks f.o.r.

FORMALDEHYDE, 40 PER CENT.—Slight inquiry and little business done. Quoted £80 per ton ex wharf.

GLAUBER SALTS.—Inclined to be a little firmer, possibly owing to dearer quotations from the Continent. Quoted £6 per ton tech. pure f.o.r.

GLYCERINE, B.P. PURE.—Spot lots offered at 105s. per cwt. ex warehouse. Parcels offered from Holland at lower prices.

MAGNESITE, GROUND CALCINED.—Small business done at around £12 10s. per ton f.o.r. Glasgow.

MAGNESIUM CHLORIDE.—Price firmer at £9 per ton ex store.

MAGNESIUM SULPHATE (Epsom Salts).—Steady inquiry for small lots. Commercial quality, £9 5s. per ton; B.P., £10 10s. per ton f.o.r. Glasgow.

NITRE CAKE.—Steady demand. Price unchanged around 20s. per ton f.o.r. ex works.

POTASSIUM, BICHROMATE.—Very small inquiry. Prices 7½d. to 8d. per lb.

POTASSIUM CARBONATE, 90/92 PER CENT.—Practically no inquiry. Continental offers slightly higher this week. 96/98 per cent. offered from the Continent at £30 10s. c.i.f. U.K.

POTASSIUM CAUSTIC.—88/92 PER CENT.—Market remains quiet. Continental offers of £32 per ton c.i.f. Spot lots £34 per ton ex station.

POTASSIUM CHLORATE.—Little business and no change in price at 5½d. per lb. Continental manufacture offered at £35 15s. per ton c.i.f. U.K.

POTASSIUM PERMANGANATE.—A few inquiries for small lots. Price 8½d. to 9d. per lb.

POTASSIUM PRUSSIATE.—Market inclined to be a little firmer at 1/2½d. to 1/3d. per lb.

POTASSIUM SULPHATE, 90 PER CENT.—£16 per ton ex ship. Business light.

SODIUM CARBONATE (Refined Alkali).—58 per cent. spot lots, £9 15s. ex quay. Small demand.

SODIUM CARBONATE (Soda Cystals).—Prices remain unchanged at £6 10s. ex station.

SODIUM BICARBONATE.—Refined, recrystallised at £11 10s.; mineral water quality, £10 10s. per ton in bags ex station.

SODIUM CAUSTIC.—Solid, 70/72 per cent., £23 10s. per ton; 76/77 per cent., £25 10s. per ton ex station. A few inquiries for shipment. 98 per cent., powdered flake, £29 to £30 per ton ex station according to quality. Broken, 60 per cent., steady demand for small lots at £26 per ton ex station, ton lots.

SODIUM HYPOSULPHITE.—Very little demand. Price nominal. Commercial, £14 per ton. Pea crystals: casks, £17 per ton; kegs, £19 per ton.

SODIUM NITRATE.—Market weak at £13 10s. to £13 15s. per ton ex wharf.

SODIUM NITRITE, 100 PER CENT.—Inquiries scarce and price unchanged at £32 per ton.

SODIUM PERBORATE.—Pure white 10 per cent., active oxygen. Offered from the Continent at 1/2d. per lb. ex wharf London.

SODIUM SILICATE, 140° TW.—Very little demand. No change in price at £12 10s. to £13 per ton ex station.

SODIUM SULPHATE (SALT CAKE, 95 PER CENT.).—Price unchanged at £4 per ton f.o.b. Makers well sold for export.

SODIUM SULPHIDE, CONCENTRATED, 60/62 PER CENT.—Small business at £22 per ton ex station.

SODIUM SULPHIDE CRYSTALS, 30/32 PER CENT.—No demand. Price £13 per ton f.o.r. works.

SODIUM SULPHITE.—Practically no inquiries. Quoted £13 to £14 per ton.

SULPHUR, BEST SICILIAN THIRDS.—Government stocks are being rapidly exhausted at £4 5s. to £4 15s. per ton according to quality. Refined rock, £13; refined roll, £13; pure flowers, £14. Prices nominal, very little demand.

ZINC CHLORIDE.—Continental works quoting dearer at £23 to £25 per ton c.i.f.

ZINC SULPHATE.—Prices remain about £14 to £15 per ton. Little inquiry.

ZINC DUST, 90/92 PER CENT.—Quoted at £40 per ton c.i.f. U.K. ports, but business idle.

WAXES.—CANDELILLA: Supplies very scarce. Prices nominal at £127 10s. per ton c.i.f. U.K.—PARAFFIN SEMI-REFINED, 118/20°: No change. Business slack, 2¼d. per lb. asked.—PARAFFIN, REFINED, 140°: Some Government stocks still available at attractive prices.—WHITE PARAFFIN SCALE: Sales light. Prices nominal at £14 per ton c.i.f.
NOTE.—Prices stated are for bulk business and are not to be taken as applicable to small parcels.

Coal Tar Intermediates and Wood Distillation Products

ALPHA NAPHTHYLAMINE.—This is being offered at 2/1d. per lb.
BENZIDINE BASE.—Inquiries for the home trade. Price 8/6d. per lb. delivered, 100 per cent. basis.
BENZOL.—Market easier and 90's offering at 2/4d. per gallon ex works.
BETA NAPHTHOL.—Now being offered at lower figures. Price quoted for export inquiry 1/9d. per lb. f.o.b.
DINITROCHLORBENZOL.—Several inquiries for export. Price firm at £90 per ton f.o.b. English port.
"H" ACID.—Some inquiries for the home and export trade. Price quoted, 7s. per lb. carriage paid or f.o.b.
META XYLIDINE.—Inquiry for home trade. Price quoted, 7s. 9d. per lb. 100 per cent. basis, drums extra, carriage paid.
NEVILLE WINTHER ACID (Sodium Salt).—Some inquiries. Quoted at 7s. 11d. per lb. 100 per cent. basis, carriage paid.
ORTHO TOLUIDINE.—Offered at 1s. 6d. per lb. for home inquiry, drums extra, carriage paid.
PARANITRANILINE.—Export inquiries. Price quoted, 3s. 9d. f.o.b. Liverpool.
PHENYL 1.8. NAPHTHYLAMINE SULPHONIC ACID.—Some inquiry for home and export. Offered at 5s. 8d. per lb. 100 per cent. basis, carriage paid or f.o.b.
"R" ACID.—Inquiry for home trade. Price quoted 3s. 4½d. per lb. 100 per cent. basis, carriage paid.
"R" SALT.—Offered at the same price as "R" Acid (3s. 4½d. per lb.).
SODIUM NAPHTHIONATE.—3s. 3d. per lb. quoted 100 per cent. basis against home inquiries, carriage paid.
SULPHANILIC ACID.—Inquiry for home trade. Offered at 1s. 6d. per lb. 100 per cent. basis, carriage paid.
TOBIAS ACID.—Inquiries for home trade. Price unchanged at 6s. per lb. 100 per cent. basis, carriage paid.

German Chemical Trade Notes

FROM OUR OWN CORRESPONDENT

Berlin, February 19, 1922.

MANUFACTURERS are raising their prices from day to day, and the transport difficulties resulting from the railway strike have given rise to an unsettled feeling on the market. Spot goods can hardly be obtained, and offerings from sellers or stockholders are missed. The price of benzol has advanced from 11.20 to 17.30 marks per kilogram. Recently the Scandinavian market took up considerable quantities of industrial chemicals as raw materials for the glass, soap and paper industries. German exporters have concluded several important contracts with Czecho-Slovakian purchasers. The following are quotations given in marks per kilogram (d.= domestic price; e.=export price).

Acid, Acetic, 80%, supplies moderate, 25 mk. d.; 28 mk. e., glacial, 98/100% continues to be scarce on a firm market, at 35 mk. d., 38 mk. e. Acid, Boric, pure, 63.50 mk. d.; crystallised, 60 mk. d., powdered 62 mk. d. Acid, Oxalic, 98/100%, crystallised, 35 mk. d.; 55 mk. e. Alum, crystal-powder, 5.70 mk. d., including sack-packing; Chrome, crystallised, commercial quality, 24 mk. d.; 27 mk. e. Alumina Sulphate, 14/15%, 4.85 and 5 mk. d., 5.50 mk. e.; 17/18%, 6.45 mk. e. Antimony, subject to fluctuation of German currency, 14.50 mk. d. Barium Chloride, 9.50 mk. d. Bleaching Powder, 10. mk. d.; demand has been confined to small parcels only. Calcium Chloride, 70/75%, 3.50 mk. d. Copper Sulphate, 98/100%, large crystals, commercial quality, including barrel packing, 22 mk. d.; 24 mk. e. Copper, 2.75 mk. d. Glauber's Salt, crystallised, 2 mk. d.; 2.50 mk. e. Magnesium Chloride, fused, 4.35 mk. d., including barrel-packing, 5.10 mk. e. Dextrine yellow, 25 mk. d. Red Lead, 28 and 29 mk. d. White Lead, powdered, 32 mk. d.; in oil, 29 mk. d. Sugar of lead, crystallised, 27 mk. d. Litharge, 30 mk. d.; 32 mk. e. Potash, Bichromate, crystallised, 56 mk. d.; 62 mk. e. Potash, Carbonate, 96/98%, 23 mk. d.; 90/95%, 19.50 mk. d.; 80/84% 17.50 mk. d. Potash, Caustic, 80/92%, 24.50 mk. d. Caustic Potash, Liquor, 50° Bé., 11 and 12 mk. d. Potassium Chlorate, 23.50 mk. d.; 26 mk. e. Potassium Chromate, 34.50 mk. d.; demand has been slow. Potassium Cyanide, 90 mk. d. Potash, Metabisulphite, 32 mk. d. Potash Prussiate, yellow, 92 mk. d. Salt Cake, loose, 3.50 mk. e. Soda Ash, 96 and 98%, 6.95 mk. d. Soda, Bicarbonate, 4.50 mk. d.; 7.50 mk. e. Soda Bichromate, crystallised, 37 mk. d. Soda, Caustic, 125° and 128° Bé., 24 and 26.50 mk. d., in strong demand, Soda, Caustic Liquor, 38° and 40° Bé., 7.50 mk. d. Soda Crystals. 47 mk. d. Soda, Cyanide, 116 mk. d. Soda, Hyposulphite, 10.50 mk. d.; 11.50 mk. e. Soda, Sulphide, crystallised 30 and 32%, 10.50 and 11.25 mk. d.; concentrated, 60 and 62%, 18/19 and 25 mk. e. Sulphur, powdered, 11 mk. d. Zinc Oxide, 90 and 92%, 36 mk. d. Zinc Sulphate, 9 mk. d.; 10 mk. e. Zinc White, red-seal, 28.50 mk. d., 36 mk. e.; green-seal, 38 mk. e.

While most people are inclined to anticipate a quiet or even weak market for coal tar products in the near future, advices from Upper Silesia state the contrary and indicate a firm market with a tendency toward increased prices. This seems still more probable in view of new advance in coal prices. Recent quotations are:

Benzol, 17.50 mk. e. in tank car lots ex works, 11.20 mk. d. in iron barrels. Benzaldehyde, 70 mk. d., 80 mk. e. Beta-Naphthol, 56 mk. d. Carbolineum, 3.65 and 4 mk. d.; Coal-Tar, hard pitch: producers in Upper Silesia are asking 2.85 mk. d.; in the Saar district it has been offered at 2.70 mk. d. Tar Pitch, in lumps, 3.20 mk. d.; in blocks, 3.30 mk. d. Coal-Tar, 2.80 mk. d.; distilled, 3.50 mk. d.; prepared, 3.50 mk. d. Coal Tar Oil, pure, 3.80 mk. d. Naphthalene, pure, in flakes, 13.50 mk. d. and e.; in balls, 15.50 mk. d. and e.

Catalogues Received

Ransomes, Sims, & Jefferies, Ltd., of Orwell Works, Ipswich, who have just taken up the manufacture of the Kestner patent water tube boiler, issue a twenty-page booklet descriptive of this boiler. It describes in a clear and readable manner the construction and other salient features of the apparatus and gives eight reasons in favour of its installation. Sectional drawings of the boiler arranged with underfeed stoker, with superheater and economiser arranged for combined coal and gas firing, and sectional elevations showing circulation and the method of removing the tubes, are also supplied. These boilers are supplied in all sizes from an evaporation of 2,500 lb. of water per hour upwards, and for all working pressures up to 350 lb. per sq. in.

Leaflet No. 605, issued by Crompton & Co., Ltd., of Chelmsford, contains particulars of the firm's synchronous induction motors for electric driving, and for power factor improvement. They are claimed to possess many advantages unattained by other machines of the synchronous induction type.

Attractively produced on glazed paper and printed in various colours a catalogue issued by Ackroyd & Best, Ltd., of Beacon Works, Morley, near Leeds, describes and illustrates (*inter alia*) miners' and surveyors' lamps and re-lighting apparatus; acetylene lamps for mines and quarries; "Hailwoods" refractory furnace cement; automatic tub or corve greasers or oilers; glasses for all kinds of electric lamps; and hot or cold stampings, pressings and piercings.

In a pamphlet relating to the Wilton's patent forced draught furnace, the Chemical Engineering & Wilton's Patent Furnace Co., Ltd., assert that it is the only forced draught furnace with a guaranteed equal draught throughout the length of the grate. An alteration in the shape of the fire-bars introduced into the latest model is said materially to increase the life of the bars. Diagrams are given showing the general arrangement of the furnaces, separately and fitted into Lancashire, Babcock & Willcox water-tube, and vertical type boilers.

"Flexala" and "Resiline" centrifugal pumps for handling liquids charged with acids, solids, fibrous and abrasive materials are dealt with in a new brochure issued by Vickers, Ltd., of Broadway, Westminster, London. The "Resiline" pump, the impeller and the interior of the casing of which are covered with a lining of rubber, is claimed to be invaluable in dealing efficiently with pickling acids and many other corrosive fluids. It is also said to have achieved considerable success in pumping the very erosive sands and slimes met with in the treatment of ores.

"Power Transmission by Chain," a ninety-four page booklet from Brampton Brothers, Ltd., of Oliver Street, Birmingham, deals fully with the advantages and efficiency of chain gearing and contains much important data relative to chains and chain wheels for the consideration of engineers and power users when incorporating chain gearing. The installation and maintenance of chain gearing are adequately dealt with, and the diversity of purposes for which the firm have supplied this form of gearing indicated. Copies may be obtained free on application to the company.

Company News

NICKEL CORPORATION.—The accounts to March 31 last show a loss for the year of £1,775 transferred to the International Nickel Co. The annual meeting will be held at 147, Leadenhall Street, London, on February 28 at noon.

HARRISON, BARBER & Co., LTD.—The net profit for 1921 was £3,172 and £1,376 was brought in, making £4,548. As announced in THE CHEMICAL AGE last week, the directors have decided to pay a dividend of 2½ per cent. for the year, carrying forward £1,298. The annual meeting was held on Thursday at the Cannon Street Hotel, London.

ARIZONA COPPER CO.—The report to September 30 last discloses a debit at profit and loss of £344,090. The directors state that the submission of the accounts is only formal, because the company's business was transferred to the Phelps Dodge Corporation, America, on October 3 last. On January 4 the company received from Phelps Dodge a payment equal to £11,918, which is subject to British taxes. The sum is not sufficient for a distribution of dividend to the ordinary shareholders.

NEW TAMARUGAL NITRATE CO.—The accounts for the year to July 31 last show a gross profit of £168,080. After deducting London expenses, £4,650; and reserve for income tax, £2,500; depreciation of investment, £1,369; redemption of and interest on first mortgage debentures, £20,120, there remains £139,441, and £17,715 was brought in, making £157,156. An interim dividend of 5 per cent. was paid in July last, £13,648; provision for 4 per cent. interest on income bonds for year, £2,983; and amortisation of income bonds account (5 per cent. of total issue), £6,215. The further dividend (already announced) of 10 per cent. (2s. per share) is payable on March 1, making 15 per cent. for year. There remains to be carried forward £107,014, subject to excess profits duty and corporation profits tax. Profit has been taken in the accounts on 594,000 quintals of nitrate sold. Manufacture was suspended at *oficina* La Patria in March and at *oficina* La Palma in May last. The annual meeting will be held at Winchester House on February 28, at 2.30 p.m.

Quantitative Fluorescence of Cellulose

AT a meeting of the Manchester section of the Society of Dyers and Colourists on Friday, February 17 (Professor E. Knecht in the chair), Dr. S. Judd Lewis, F.I.C., in a paper on "The Quantitative Fluorescence of Cellulose, its Derivatives, and Certain other Substances," stated that he had found that when an ultra-violet spectrum of wave lengths 3,300 to 2,100 (invisible to the naked eye) was projected on to a sheet of note paper or a piece of bleached cotton fabric, the spectrum became "degraded," *i.e.*, the ultra-violet rays became converted into visible rays which could be photographed by means of an ordinary camera. It was found that under the same conditions the various papers and fabrics examined gave photographic images of varying intensities according to their composition and mode of manufacture. By acetylating the cellulose its fluorescence was enormously increased, while nitration depressed this constant almost to vanishing point. Different forms of cellulose had also been examined and the results obtained were shown. The various treatments to which cotton fabrics were submitted in bleaching as well as the degree of beating of pulp in paper manufacture all found expression in the photographic images, so that it would appear that an application of the method to the examination of industrial products might be anticipated.

Committee for the Analysis of Coal

THE Fuel Research Board of the Department of Scientific and Industrial Research have appointed a committee to advise upon the sampling and analysis of coal. The personnel of the committee is as follows: Professor Thomas Gray (chairman); Professor J. W. Cobb; Dr. J. T. Dunn, Dr. J. S. Flett, Mr. G. Nevill Huntly; Mr. S. Roy Illingworth; Mr. J. G. King; Dr. C. H. Lander; Dr. R. Lessing; Mr. C. A. Seyler; Mr. F. S. Sinnatt; Professor R. V. Wheeler; Miss N. Renouf (secretary). It is intended that the methods recommended by the committee shall be adopted in connexion with the physical and chemical survey of the national coal resources. Communications for the committee should be addressed to the secretary, at 16 and 18, Old Queen Street, Westminster, London, S.W. 1.

Chemical Trade Inquiries

The following inquiries, abstracted from the "Board of Trade Journal," have been received at the Department of Overseas Trade (Development and Intelligence), 35, Old Queen Street, London, S.W.1. British firms may obtain the names and addresses of the inquirers by applying to the Department (quoting the reference number and country), except where otherwise stated.

LOCALITY OF FIRM OR AGENT.	MATERIALS.	REF. No.
South Africa..	Drugs, pharmaceutical chemicals.	209
Danzig	Paraffin candles	213
Marseilles ..	Fats for soap-making, &c.	215
Riga	Soap, chemicals, oils	216
Amsterdam ..	Benzine tanks (1,000 and 3,000 tons capacity).	D. O. T. 14323/ E.W./ P.H.
Boston (U.S.A.)	Fertilising products.....	226

Tariff Changes

AUSTRALIA.—A dumping duty for the protection of local industries and imports from the United Kingdom also provides for the collection of a duty on goods coming from countries with depreciated exchange, which compete unfairly with goods manufactured in the United Kingdom. The complete text of the measure, which is known as the Customs Tariff (Industries Preservation) Act, 1921, was published in the Board of Trade *Journal* (February 16, p. 189).

BRITISH GUIANA.—The text of a new Customs Tariff, which introduces a revised Preferential Tariff, may be inspected at the Tariff Section of the Department of Overseas Trade, 35, Old Queen Street, London.

VIRGIN ISLANDS.—Schedules of import and export duties and of free goods in connexion with a revised Preferential Customs Tariff may be seen on application to the Tariff Section of the Department of Overseas Trade.

SAN SALVADOR.—As from December 5 last chlorides of lime and calcium may be imported free of duty.

SPAIN.—The new Customs Tariff, which has been in course of preparation for some time past, was promulgated on February 13 and became effective on February 16 with minor exceptions. A special supplement containing details of the Tariff was published in the Board of Trade *Journal* of February 24.

MEXICO.—As from January 1 last crude mineral oil may be imported into Mexico free of duty. The export duty on rubber and guayule gum is withdrawn as from January 6.

PORTUGAL.—Warehousing charges collected by the Customs authorities are tripled as from January 14.

SERB-CROAT-SLOVENE STATE.—Regulations regarding the importation and trade in patent medicines, &c., may be inspected at the Tariff Section of the Department of Overseas Trade.

SWITZERLAND.—The bureau dealing with the imporations of paraffin oil and benzine will be closed down on March 1.

TUNIS.—The following import duties came into force on January 1 and affect the products of all countries, including France and Algeria: Lubricating oils, and other heavy oils and residues, 5 fr. per 100 kilos. (net weight); mazout, 0.40 fr. per 100 kilos. As from January 1 last the export duty on phosphate has been reduced from 2 francs to 1 franc per metric ton.

CANADA.—New regulations regarding the importation of oleo-margarine into Canada were published in the Board of Trade *Journal* (February 9, p. 162.)

Rothamsted Experimental Station

THE Fertilisers Manufacturers' Association and the British Sulphate of Ammonia Federation have placed at the disposal of the committee of the Rothamsted Experimental Station, Harpenden, funds which have enabled them to appoint a special member of the staff to explain the plots to visitors, and Mr. H. V. Garner, of the School of Agriculture, Cambridge, has accepted the post. It is now possible to accommodate more parties of visitors, and Dr. E. J. Russell, the director, will be happy to arrange with secretaries of farmers' clubs, Chambers of Agriculture, and other bodies interested.

Commercial Intelligence

The following are taken from printed reports, but we cannot be responsible for any errors that may occur.

London Gazette

Company Winding Up Voluntarily

HIGH EXPLOSIVES, LTD. R. Miller, 42, Spring Gardens, Manchester, appointed liquidator. Meeting of creditors at the liquidator's office, on Friday, March 3, at 3 p.m. Particulars of claims by March 3 to the liquidator.

Liquidator's Notice

KEELING'S OXIDES, LTD. Particulars of claims by March 15 to F. W. Carder, the liquidator. N.B.—All liabilities, so far as it is known, have been discharged, and the above notice is inserted in compliance with the requirements of the Companies Acts, 1908, &c,.

Edinburgh Gazette

WAVERLEY GLASS WORKS, LTD. Voluntary winding-up agreed to. J. R. Davidson, C.A., 81, Mitchell Street, Glasgow, appointed liquidator.

County Court Judgments

[NOTE.—The publication of extracts from the "Registry of County Court Judgments" does not imply inability to pay on the part of the persons named. Many of the judgments may have been settled between the parties or paid. Registered judgments are not necessarily for debts. They may be for damages or otherwise, and the result of bona-fide contested actions. But the Registry makes no distinction of the cases. Judgments are not returned to the Registry if satisfied in the Court books within twenty-one days. When a debtor has made arrangements with his creditors we do not report subsequent County Court judgments against him.]

BRADLEY, Vivian, The Pharmacy, Shotton Colliery, chemist. £17 13s. December 9.

DODS, Henry, 33, Lightburn Street, Runcorn, chemist. £26 19s. 6d. December 19.

LLEWELLYN, W., Tonypandy, chemist. £22 6s. 6d. December 2.

STANSFIELD, J. L., Boothfield, Waterfoot, chemical manufacturer. £13 18s. 8d. December 2.

STEWART, J. D., 100, Richmond Road, Earl's Court Road, chemist. £22 1s. December 6.

WATSON HERRING & CO., 12, Matlock Road, Brighton, chemists. £10 8s. 8d. December 13.

Bill of Sale

[The undermentioned information is from the Official Registry. It includes Bills of Sale registered under the Act of 1882 and under the Act of 1878. Both kinds require re-registration every five years. Up to the date the information was obtained it was registered as given below; but payment may have been made in some of the cases, although no notice had been entered on the Register.]

BARRICK, Frederick, The Van, back Avenham Grove, off Banks Street, Blackpool, soap manufacturer. £65. Filed February 15.

Mortgages and Charges

*[NOTE.—The Companies Consolidation Act, of 1908, provides that every Mortgage or Charge, as described therein, created after July 1, 1908, shall be registered within 21 days after its creation, otherwise it shall be void against the liquidator and any creditor. The Act also provides that every Company shall, in making its Annual Summary, specify the total amount of debts due from the Company in respect of all Mortgages or Charges which would, if created after July 1, 1908, require registration. The following Mortgages and Charges have been so registered. In each case the total debt, as specified, in the last available Annual Summary, is also given—marked with an *—followed by the date of the Summary, but such total may have been reduced since such date.]*

BLEACHERS' ASSOCIATION, LTD., Manchester.—Registered, February 7, indenture (supplemental to mortgage registered September 21, 1912), increasing rate of interest payable on £50,000 outstanding, to R. T. Stowell, 56, Brown Street, Manchester, and others; charged on hereditaments at Radcliffe and certain yearly rents payable out of hereditaments at Warth. *£2,250,000, £75,000, £56,000, £90,000, £50,000, £65,000, £50,000. July 5, 1921.

BRITISH GLASS INDUSTRIES, LTD., London, E.C.—Registered February 10, £100, £5,600, £700 and £900 debentures part of £400,000; general charge (excluding uncalled capital). *£280,500. October 19, 1921.

GREGORY (WILLIAM), LTD., London, S.E., manufacturing chemists.—Registered February 9, £300 debentures, part of £2,000; general charge. *Nil. January 6, 1921.

JOHNSEN & JORGENSEN, LTD., London, E.C., glass manufacturers.—Registered February 8, charge to Hambros Bank, Ltd., securing all moneys due or to become due to the bank; charged on Thames Wharf, Charlton. *Nil. January 4, 1921.

Satisfaction

NEW PACCHA & JAZPAMPA NITRATE CO., LTD., London, E.C.—Satisfaction registered February 13, £25,000, registered November 17, 1908.

Receiverships

GRAHAM & COPE, LTD. J. Croft, C.A., of Dewsbury, was appointed receiver and manager on February 8, 1922, under powers contained in debenture dated September 8, 1921.

NICOL RULE CO., LTD. G. D. Haynes, of 97, Mortimer Street, W., was appointed receiver and manager on February 4, 1922, under powers contained in debenture dated July 15, 1921.

G. M. WILLIAMS & CO., LTD. C. A. Radermacher, of 36, Camomile Street, E.C., ceased to act as receiver or manager on February 6, 1922.

New Companies Registered

AMERICAN PETROLEUM DISTRIBUTING CO., LTD. Finsbury Court, London, E.C. Dealers in oil, petroleum, petrol, and oil and petroleum properties. Capital, £1,000 in £1 shares.

B. W. CLEGG & SON (LEEDS), LTD. Manufacturers of and dealers in glass bottle and other machinery, &c. Capital, £6,000 in £1 shares. A subscriber: T. Jubb, Beechwood, Broad Lane, Bramley, Leeds.

COWAN & CO. (LONDON), LTD. To enter into a verbal agreement for the acquisition from C. S. Bingham of the business and assets carried on by him at 143 and 144, Fleet Street, E.C., as "Cowan & Co." as from February 1, 1922, and to carry on the business of importers, manufacturers and exporters of and dealers in wax, lubricating oils, petroleum and petroleum products, turpentine, resin, bitumen, tallow, casein, rubber and oils and seeds of all kinds, pharmaceutical, medicinal, chemical, industrial and other preparations, &c. Capital, £5,000 in £1 shares (1,000 preference and 4,000 ordinary). A subscriber: H. Birnage, 17, Crowstone Road South, Westcliff-on-Sea.

ESPARTO PAPER MILLS, LTD. Manufacturers of and dealers in paper and pulp of all kinds and similar substances and articles of, or from paper, pulp and esparto, &c. Nominal capital, £10,000 in £1 shares. A subscriber: E. H. Wiseman, Morea, Severn Avenue, Gidea Park, Essex.

FIRTH BROS (OSSETT), LTD., Palesides Mill, Dewsbury Road, Ossett. Manufacturers of and dealers in oils, lubricating grease and engine packings of all kinds, asbestos, rubber, cotton and mill waste, oil refiners, tallow melters, grease extractors and makers, &c. Capital, £1,000 in £1 shares.

GENERAL SALES CORPORATION, LTD. Merchants, manufacturers of, and dealers in, chemicals; aniline and other dye makers, soap makers, &c. Capital, £500 in £1 shares. A director: E. Evans, Sunnybank, Uplands, Swansea.

HALLER & PHILLIPS, LTD, Mildmay Chambers, 69, Bishopsgate, and 7, Union Court, Old Broad Street, both in London. Chemical and general merchants and brokers. Capital, £10,000 in £1 shares (6,000 preference and 4,000 ordinary).

UNITED PHOSPHATE AND MALT CO., LTD., Needham Market, Suffolk. Importers, manufacturers of and dealers in phosphates and other chemicals, malt products, &c. Capital, £4,000 in £1 shares.

YORKSHIRE TILLAGE CO., LTD, 38, Portland Crescent, Leeds. Manufacturers of fertilisers and manufacturing chemists and chemists' agents. Capital, £1,000 in £1 shares.